AN OGDEN PUBLICATION DEVOTED TO GLASS TECHNOLOGY, ENGINEERING, MATERIALS AND GLASS FACTORY EQUIPMENT AND OPERATION

the glass industry

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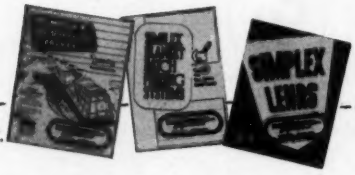

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THE GLASS INDUSTRY

VOLUME 35, NUMBER 5, MAY, 1954

THE GLASS DIVISION AT CHICAGO

The 56th Annual Meeting of the American Ceramic Society was held at the Palmer House, Chicago, Illinois, April 19-23. The meeting was honored by the presence of R. W. Douglas, Glass Technologist, General Electric Ltd., and Honorary Secretary of the Society of Glass Technology in England.

F. L. Bishop, Kimble Glass Company, subsidiary of Owens-Illinois Glass Company, and A. C. Siefert, Owens-Corning Fiberglas Corp., presided as Chairman of the Division in the absence of Chairman N. J. Kriedl, Bausch & Lomb Optical Company. The Program Committee of T. G. Pett, Chairman, F. W. Mowrey and John W. Michener was responsible for an excellent program of seventeen papers devoted to various phases of glass technology.

The first paper, "Internal Friction at Low Temperatures and High Frequencies in Fused Quartz", by O. L. Anderson, H. J. McSkimin, M. E. Fine and H. E. Bommel, Bell Telephone Laboratories, was presented by O. L. Anderson. An interesting phenomena of absorption of ultrasonic waves at low temperatures by fused silica was observed and is believed to be due to structure in the glassy state. This absorption of high frequency sound waves in fused silica showed a significant peak in the temperature range of 30° to 50°K. Data were also presented showing the variation of elastic moduli and internal friction with temperature and frequency.

The absorption appeared to result from some property of the glassy state, since it did not occur in crystalline silica. The phenomenon was explained as due to the transverse oscillation of the oxygen atom or motion of this atom in the transverse position. It was therefore due to internal structure and not to chemical changes because the structure of glass is not entirely random, but partially oriented. The phenomenon is also evident at higher temperatures (room temperature) at supersonic vibrations. Other properties such as specific heat as observed by Smyth, and the Raman effect as observed by Douglas, tend to support the above theory.

The paper was highly theoretical and was a speculative interpretation of observed experimental effects. Various interpretations were considered, such as thermoelastic effects, static histeresis, viscous flow and phase transformations, but the effects of structural relaxation as described by the transverse movement of oxygen appeared to be the more plausible.

The next paper, "Foreign Fourcault Practice", written by T. G. White (deceased), was read by F. V. Tooley, University of Illinois. This paper was extremely practical and revealed the experiences of "Teddy", as he was affectionately known by his friends, in such various foreign countries as Norway, Denmark, Western Germany, Russian-occupied Austria, Israel, Japan, Columbia and Mexico. The paper dealt broadly with Fourcault process as used in these countries. Some of the highlights follow.

In Norway electrical melting offers many problems in the proper heat distribution of the tank. The labor situation in Denmark is quite satisfactory because the laborers are all farmers and, as landowners, are very considerate of management and ownership. In Germany the quality of the glass was exceptionally good and suspended-roofs are used instead of crowns. Austria at present is in a state of over-production and electric boosting has given way to natural gas. Israel offers many problems owing to lack of raw materials, fuels and industrial background. Japan provides high quality glass with exceptionally good refractories, and skilled labor offers little interference with technical advancement. Columbia and Mexico offered the poorest labor. Columbia is hampered by very poor transportation, and Mexico surprisingly used natural gas from Texas.

White pointed out that so-called "slave labor" was not as bad off as many believe, especially in Western European countries, because the workers live well, are well fed and do not have the additional living costs experienced in the United States. Many foreign countries have now become strong manufacturers and exporters because imports formerly sent them were of inferior quality.

The third paper, "The Strength Versus Diameter of Glass Fibers", was presented by W. H. Otto, Owens-Corning Fiberglas Corp. This excellent paper presented considerable experimental evidence to show that the strength of glass is *not* entirely dependent upon fiber diameter. It was formerly believed that the breaking stress greatly increases as the fiber diameter decreases. The work of

R. W. Pafford, newly-elected A.C.S. President

Griffith, Murgatroid, Andregg and others have supported this belief.

Otto reasoned that fibers of smaller diameter have been made from hotter glass, drawn faster and quenched more rapidly, and hence have higher strength. If conditions of fiber formation are constant and under the same environment, the difference in strength is less noticeable with change in fiber diameter. The fiber-forming conditions are therefore highly important.

The results of tests using a lime-alumina-borosilicate type of glass were given. A single-hole bushing type of apparatus was used, and tensile strengths were made on uncoated fibers by means of a chainomatic type tensile test. The effect of fiber diameter was less contributing than formerly believed. The effects of bushing temperatures (drawing temperatures), rate of pull and rate of cooling were believed to be of great influence on the strength. When fibers of different diameter were formed under controlled, nearly identical, conditions, the breaking strengths were nearly identical and there was no significant effect of diameter as such.

Another paper related to the glass fiber, "Further Use of Selected Area Electron Diffraction for Studying Glass Structure", by J. W. Michener and J. G. Sayre, Owens-Corning Fiberglas Corp., was presented by Mr. Michener.

Electron micrographs of extremely high magnification were shown. The limit of resolution was about 35,000-40,000 magnifications; otherwise the effects of photographic grain size became apparent.

Simple soda-silica glasses were studied, and evidence of a micellar structure was apparent. As the soda was increased to approximately 50% Na_2O, evidence of crystallization became stronger and less micellar structures could be seen. The present study was confined to simple glasses so that the number of variables could be reduced to a minimum. Micellar structure has also been observed in fused silica. Examples of glass fibers were also shown to possess a micellar structure. Future work has been planned to study the effects of annealing and thermal treatment on the structure of glass.

A paper, "Fine Annealing of Optical Glass", by H. R. Lillie and H. N. Ritland, Corning Glass Works, was presented by Mr. Ritland. Optical glass requires a greater accuracy of annealing to bring about less stress and a uniform fictive temperature T. These may be accomplished by uniform heating or proper time and temperature treatment in the critical range where adjustments take place.

Curves were presented to show the effect of rate of cooling to produce a desired room temperature index. If the temperature and rate of cooling are adjusted, the desired control may be attained. Because the most important characteristic of optical glass is the uniformity of its refractive index, which is itself a function of fictive temperature T, any fine annealing treatment must be such as to bring about substantial uniformity in T. In terms of total required time in the annealing process, the most efficient method consists of soaking the glass for a time t_s at a temperature T_1, near the annealing point, cooling at a constant rate R to a temperature T_2 and at an increased rate to room temperature. Formulas were given for specifying T_s, t_s, R, T_2 in terms of the final condition of the glass as to stress and index.

Desired annealing schedules were given for specific glasses of known compositions and were shown to provide appreciable savings in annealing times. Applications to glasses other than borosilicates were shown, and it was indicated that flint glasses required less annealing time. In the method of constant rate annealing, the homogeneity and stresses are believed to be under control at all times. This factor thus provides more perfect control of the properties of the glass.

The next paper, "The Constitution of Soluble Phosphate Glasses", by A. E. R. Westman and Joan Crowther, Ontario Research Foundation, Toronto, Ontario, Canada, was presented by Mr. Westman. A chromatographic technique was described that has been ingeniously applied to the analyses of various phases present in phosphate reactions. Filter paper chromatographic methods have been developed which permit the separation and determination of condensed phosphate anions having ring structures with three or four phosphorous atoms per ring and of linear structures containing from one to nine phosphorous atoms per chain.

In view of the fact that some of the reactions produced phosphate glasses, this method of analysis is believed to be helpful in evaluating the constitution of this type of glass. X-ray and other evidence were presented which indicated that the structures of condensed phosphate anions found in solution corresponded to similar structures of condensed phosphates in the glass before dissolutions, and did not arise during the solution process. The study thus supports the polymer as opposed to the Zachariasen approach to the constitution of glasses.

The high solubility of phosphate glasses may be explained by the simple chain structure that is present in some of the compositions. Attempts to apply a similar procedure to the analyses of silicates have been quite difficult, and work is at present under way to analyze borates by this procedure.

"Expansion of Vitreous Silica" was the title of the next paper by Harold T. Smyth, School of Ceramics, Rutgers University. The expansion of fused silica is low and becomes negative at lower temperatures. A study of the geometry of the network shows that the frequency of transverse vibration of the oxygen atoms decreases as the structure is squeezed close together. In this respect these frequencies behave differently from most vibration frequencies in crystal lattices and glass networks which increase as the structure is forced together. The analysis of vibration and movement of the oxygen atoms plays an important role in this change in expansion. The major contribution to the specific heat of vitreous silica is also said to come from the transverse vibration of the oxygen atoms. The characteristic property of fused silica in regard to specific heat may also substantiate the characteristics shown in regard to expansion.

Negative expansion is consistent with the simple Zach-

F. L. Bishop

ariasen theory but is best explained on the basis of the transverse vibrations of the oxygen atoms.

The next paper, which was the first paper given in the Joint Session with the Basic Science Division, was a highly theoretical one. It was "Physical Chemistry of Finely Subdivided Matter" by W. Weyl, Department of Mineral Technology, Pennsylvania State University.

The surface chemistry of glass, as well as various ceramic products, is highly important and definitely related to the various properties of the products. Hauser was one of the first to confirm the idea that ultimate failure was due to the reduction of individual particles in one direction to unit dimension.

Surface energy varies greatly depending upon the degree of polarization. This is also said to explain the need of super-saturation to form crystals. Four factors which determine surface energy are (1) Formation of dipoles in surface ions, (2) Excess of anions over cations, (3) Distortion of surface and removal of cations into the interior (depth action), (4) Absorption of molecules and anions. In the fine division of quartz, the SiO_4 tetrahedron is distorted giving a brownish coloration. This is a strong characteristic of the greater surface area of the particles. The color is definitely reduced by the addition of a polarizable ion.

The results of depth action are many times apparent in solid state chemistry and are the final explanation of the surface forces of thin films, fibers or reactions between small particles. The interaction of atoms over long distances is involved in the strength, scratch hardness and fracture of glasses. This new approach to the nature of chemical binding forces is the result of recent work sponsored by the office of Naval Research.

The paper, "Determination of the Resistivity of Lossy Materials from Dielectric Measurements, Making Use of Interfacial Tension", by R. T. Lewis, New York State College of Ceramics, Alfred University, and L. R. Bickford, Jr., International, Business Machines Corp., was presented by Mr. Lewis.

The phenomenon of interfacial polarization complicates dielectric measurements at low frequencies. These effects of interfacial polarization were studied by means of a model composed of a thick piece of glass and a thin section of mica. The mica barrier was about 1/60 that of the glass thickness. The loss in resistance mica was much less than that of the glass. The effect leads to a psuedo-Debye relaxation process in a frequency or temperature spectrum of dielectric constant and loss, with the relaxation time determined by the physical dimensions of the barrier layer and by the resistivity of the bulk material. Values of resistivity and activation energy obtained by this method agreed very well with values obtained by D. C. measurements.

A very interesting paper entitled "High Pressure Minerals" was presented by Loring Coes, Jr., Norton Company. High pressure techniques were used to synthesize compounds that might be applicable to the abrasive industry. The reactions were carried out at pressures up to 45,000 atmospheres and temperatures up to 1000°C. The work was first conducted with known hydrated minerals.

Epidote rocks were first synthesized, and such rocks as garnet, pyroxene, kyanite, sodalite and pyrope were all formed. Gyrope ($Mg_3Al_2(SiO_4)_3$) was synthesized by reacting talc and kaolin. A small amount of iron was found to alter the reaction considerably. Solid solutions were also possible. Jadeite was formed as follows:

$$2NaCl + Al_2O_3.2SiO_2.2H_2O + 2SiO_2 \rightarrow 2NaAl(SiO_3)_2$$

Corundum, illemanite and others were also formed by reactions occurring at 20,000 to 30,000 atmospheres.

Two new crystals were formed: a dense form of SiO_2 and an iron bearing aluminum silicate $Al_2O_3.3SiO_2$. The new form of silica had a density of 2.31 and was quite stable. It converted to cristobalite and glass at 1400°C. and was not soluble in hydrofluoric acid. The techniques employed are useful in studying naturally occurring minerals and also offer a means of developing unusual new materials.

The last paper presented in the joint session with the Basic Science Division and the Glass Division was "Effects of Nuclear Reactor Exposure on Some of the Properties of Vitreous Silica and Quartz" by W. Primak, L. Fuchs and P. Day, Chemistry Division, Argonne National Laboratory. The paper was presented by Mr. Primak. In a nuclear reactor ionization takes place, while color changes on the surface are apparent and displaced atoms are evident.

Some of the changes observed in physical properties of quartz were decrease in density, increase in lattice constant, marked diffuseness in the back-reflection region of the X-ray diffraction patterns, a marked change in rotatory power, a decrease in refractive index and birefringence, and a change in heat capacity. X-ray evidence indicated that crystals tended to be reduced to the glassy state.

The effects of the nuclear reactor are explained as a series of multiple collisions taking place in which an energetic neutron collides with an atom to bring about displacement. Changes observed in vitreous silica are increases in density and increases in refractive index. These changes are believed to be due to displaced atoms that lodge or are caught in the interstices or hole position in the structure. Observations were made on discs 3 mm. in diameter, and little change was noted on heating or annealing. The color changes were believed to be due to gamma absorption. The effects of exposure to nuclear reactors can be expected to assume greater importance in the future with the greater use of atomic power.

The first paper presented at the Thursday morning session was "Wettability of Certain Metals by Potassium Silicate and Sodium Borate Glasses" by Joseph A. Pask, Alex Kaminski and Davis W. Mitchell, Division of Mineral Technology, University of California. The paper was presented by Mr. Pask.

The contact angles of sodium silicate, potassium silicate and sodium borate glasses were measured at 900°C. in vacuum. The studies were made by placing a small amount of glass on a piece of metal approximately 1 × 2 × 5 cm. in size. Various metals were used, such as gold, platinum, iron, tantalum, molybdenum and tungsten. The measurements were made in a zirconium tube vacuum furnace. The vacuum at operating temperatures of 900°C. was of the order of 10^{-4} mm. Hg. The contact angles were studied with change in time, and the important fact was that the contact angle might vary until complete wetting occurred. The effect was followed up to 48 hours until an equilibrium angle was reached or until complete wetting occurred.

In general, the sodium silicate glasses showed less change in contact angle with time than the other glasses. This change varied somewhat, however, with the different metals. The sodium borate glasses tended to show more complete wetting than the sodium silicate or potassium silicate glasses. In spite of the fact that the tests were carried out in vacuum, the possibility of reaction between glass and metal or metallic oxide was discussed. Sodium borate ($Na_2O.3B_2O_3$) showed complete wetting of platinum, molybdenum and tungsten. Sodium silicate ($Na_2O.SiO_2$) showed little tendency to wet gold and platinum. The paper presented results that should be of considerable practical value.

The next paper, "Recent Applications for Conductive Glass in the Lighting Field", by Richard M. Rulon, Sylvania Electric Products, Inc., was of extreme interest. Mr. Rulon described a radically new departure in the field of illumination: electroluminescence. This novel means of lighting is accomplished by imbedding a suitable phosphor in a dielectric material, and positioning the phosphor-dielectric mixture in a thin layer or sheet between two conductive surfaces, at least one of which is light transmitting. As the two conductive surfaces or electrodes are connected to an alternating current source, the phosphor emits light.

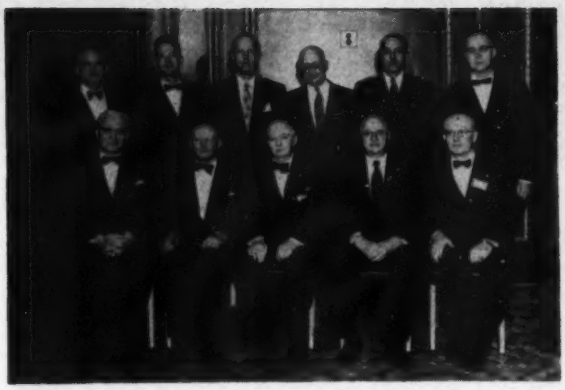
Zinc sulfide (ZnS) phosphors were used together with tin oxide electrically conducting coatings on sheet glass. Either plate or window glass may be used as the dielectric. This form of lighting provides a number of advantages: (1) There is an area source of light and not a small wire, (2) High temperatures are not required, (3) No vacuum is required, (4) The decline in life output is quite slow, (5) Equipment possesses good mechanical strength, (6) Uniformity of light over large area.

The electrical properties compare well with other types of lamps. Brightness goes up very rapidly with increased voltage. In order to produce a desirable illumination level within a room, however, quite large glassed areas would have to be illuminated or coated. The method of attaching the leads to the glass is very important. Various pastes and sprayed metal connections have proven to be the best. Various colors are possible, and the lighting effects are quite pleasing. This method of illumination offers considerable possibilities in the future.

A practical paper, "A Flow Type Viscometer for Measuring Glass Viscosity", by R. L. Tiede, Owens-Corning Fiberglas Corp., was given next. An interesting and practical method of measuring viscosity of glass fibers was presented. The method consisted of estimating the time required for a given glass to flow through an orifice of a one-hole bushing. The method is useful in the range of 100 to 450 poises, and requires a comparison with an arbitrarily chosen standard glass.

The standard glass was first run by heating to a temperature for 100 poises and glass drawn from the bushing. The amount of glass (about .04 gms.) was weighed per minute draw, and this served as a standard for unknown determinations. Various fiber weights for varying temperatures of draw were plotted and comparisons made with standard glasses of known viscosity.

Many advantages are apparent. The results were obtained over a wide range of temperatures, small samples only were needed, reproductibility was good and the fibers may be used for other tests, such as durability. The test yielded practical results that can be useful to production. The disadvantages are that absolute viscosities were not obtained and the orifice-bushing and temperature distribution were complicated.



Officers and new trustees of the Society are, left to right: Seated, President-elect Robert Twells, President Ray W. Pafford, Past-president R. R. Danielson, Treasurer William E. Dougherty, and General Secretary, Charles S. Pearce. Standing, Vice Presidents John F. McMahon, William O. Brandt and Rolland R. Roup; new Trustees Herbert Insley of the Basic Science Division, Paul V. Johnson of the Structural Clay Products Division, J. S. Nordyke of the Materials and Equipment Division.

The next paper, "Adaptation of Replica Technique to the Measurement of Surface Durability of Glass", by H. E. Simpson, New York State College of Ceramics, Alfred University, was related to the surface durability of bottles and containers.

A replica technique was developed for reproducing the corroded surface of glass containers. A wide variety of techniques was first studied which involved the use of various sheet plastics, such as ethyl cellulose, and various solvents. Most of the methods tried were of little value with curved surfaces because of the difficulties involved in uniformly pressing the plastic sheet upon the irregular contour of the bottle glass sample.

A liquid plastic composed of vinylite dissolved in methyl isobutyl ketone or acetone gave very encouraging results when properly applied and dried. The previously weathered samples of bottle glasses were dipped in the plastic solution, and after careful drying under controlled conditions, the plastic film was stripped from the surface to produce an accurate reproduction of the corroded glass surface. The degree of surface deterioration, as evidenced by the replica, was then determined by means of a photoelectric haze meter.

Some typical results taken from a study of various container glasses indicated that, as a rule, the inside of the container deteriorated more rapidly than the outside. The pattern of corrosion on the outside of the container was quite irregular and distinguished by long flowing lines, such as feeder marks, cutter marks, mold marks and the like. The inside of the container showed considerably less irregularities. The high alumina glasses were the most durable and were slower to break down or disintegrate. Magnesia appeared to contribute some beneficial effect toward durability. Glasses which approximated the dolomite ratio (CaO/MgO) were better

(*Continued on page* 278)

EVALUATING THE PERFORMANCE OF CONTINUOUS GLASS MELTING TANK FURNACES

By D. E. SHARP AND L. B. GINTHER
Libbey-Owens-Ford Glass Company, Toledo, Ohio

The performance of continuous tank furnaces has always been gauged by the amount of fuel required per ton of product. From the standpoint of operating costs, such an index will always be necessary and important, but from the point of view of engineering analysis for improvement of furnace design and operation, it is quite unsatisfactory because of the strong dependence of the index on variation in tonnage output.

In order to supply the data that are essential for evaluating the effects of design changes, a committee of the British Society of Glass Technology has devoted a great deal of time and study for the past 25 years to methods for appraising the performance of glass tank furnaces. These studies culminated about 10 years ago in a proposed standard method which was adopted by the British Standards Institution in 1946. This comprehensive code for the complete evaluation of the performance and efficiency of furnaces admittedly has some drawbacks, but has much to commend it. It has not received acceptance in the U. S. A. for various reasons, but in the authors' opinion its merits greatly exceed its disadvantages.

Fundamentally the method calls for a determination of the heat required per unit area to maintain the furnace at operating temperature when no glass is being drawn, and ratios this heat to what would be its equivalent for a furnace of standard dimensions and standard operating conditions. The method is simple and is easily understood and applied. It is susceptible to short-cuts in many phases of its procedure, or it may be refined to quite high precision that does not compare unfavorably with a complete heat balance determination. Unlike the heat balance, however, a useful figure for many of the purposes of the engineer can be obtained at very frequent intervals generally with the aid only of the normal operating data that are recorded on the furnace operator's daily log sheet.

The original work of Hampton[1], Moorshead[2], Gould[3] and others may be consulted for details of the reasoning behind the various elements of the procedure. The version that is furnished here has been adjusted in several respects to make it convenient for customary American practice. Thus, for example, tonnage is expressed in U. S. A. tons of 2,000 lbs. rather than in the British 2,240 lb. ton, and temperatures are given in Fahrenheit degrees, whereas the original utilizes the Centigrade system.

The basis for assessing furnace performance uses the following expression:

$$Q = \frac{1.16}{M}\left[\frac{G}{K} - CW\right]$$

Units

where

Q = Thermal performance quotient — BTU/sq.ft/sec.
G = Total fuel consumed per day — Net Therms/24 hours
W = Weight of glass discharged per day — Tons/24 hours
C = Quantity of heat required to yield one ton of glass and to raise its temperature to 2550°F (See Table 3) — Therms/Ton
M = Total area of glass surface exposed to the crown of the furnace multiplied by a correction factor to adjust furnace area to a reference of 600 sq. ft. (See Table 2) — Dimensionless
K = Correction factor to adjust average temperature to a reference of 2550°F. (See Table 1) — Dimensionless

The expression refers to a hypothetical condition of no load, obtained by making a correction for the actual load on the furnace. The calculated fuel consumption resulting from applying this correction is the quantity of fuel that is required to hold the furnace at the standard temperature by supplying the heat necessary to compensate for the heat losses from the walls of the furnace.

Correction for Temperature—Factor K

Operating temperatures vary, not only among furnaces, but in different parts of a furnace. A method of averaging the temperature in a furnace is necessary, as well as of scaling the fuel requirement to the standard temperature. For this purpose the furnace is divided into zones, each of which has a reasonably constant temperature, and the weight temperature factor is calculated. The factor K for use in the performance expression is then

$$K = \frac{A_1K_1 + A_2K_2 + A_3K_3 + AnKn}{A}$$

Unit

where

A_1 = Area of one zone (such as melting zone) — sq. ft.
A_2 = Area of another zone (such as refining zone) — sq. ft.
A_3 = Area of additional zone (such as working area) — sq. ft.
A_n = Area of zone "n". — sq. ft.
K_1, K_2, K_3, K_n = Constants from Table 1 for the average temperature of corresponding zone. — (Dimensionless)
A = Total area. — sq. ft.

An appendix distributed by Messrs. Sharp and Ginther in conjunction with a lecture on Fuel Utilization in Glass Melting delivered by Dr. Sharp at the American Gas Association Industrial Gas School, Detroit, Michigan, May 4-8, 1953.

In a bridgewall tank furnace it is generally adequate to consider only two zones; namely, the melting end area and the working end area. For sheet and plate glass furnaces, three zones generally will suffice, but four may sometimes be required if furnaces are very long and narrow and have marked longitudinal temperature gradients.

The method of taking the temperatures is one of the objectionable uncertainties in the method when it is applied by different individuals, but the engineer may standardize on his own selection of methods of taking temperatures. Optical pyrometer measurements on sidewalls of the inside of the furnace at fairly regular distances apart are probably best. Whether or not optical pyrometer data or thermocouple data are used, the type of source of the date should be consistent.

Correction for Area—Factor M

Other conditions being equal, large furnaces require less heat per unit area than do small ones. The performance quotient Q is therefore ratioed to a reference area of 600 square feet to relate it to a standard condition. Therefore, for furnaces larger or smaller than 600 square feet of total exposed glass surface area, the adjusted area is taken from Table 2 for use in the performance formula.

TABLE 1

CORRECTION FACTOR FOR ADJUSTING FUEL CONSUMPTION TO A REFERENCE OF 2550°F.

Temperature °F.	Multiplying Factor K	Diff. for 10°
3000	1.320	
		.0078
2900	1.242	
		.0073
2800	1.169	
		.0070
2700	1.099	
		.0067
2600	1.032	
		.0063
2500	.969	
		.0061
2400	.908	
		.0057
2300	.851	
		.0055
2200	.796	
		.0053
2100	.743	
		.0051
2000	.692	

Calculated from the expression

$$K = \frac{\frac{2550}{T} - (1-V)}{V}$$

where V is taken as 0.619 representing thermal efficiency of natural gas burned with 10% excess air and a heat recovery of 45%. (This table differs slightly from the original wherein a V of 0.564 was utilized.)

Correction for Glass Load—Factor C

Less heat is required to melt cullet than for batch. Values of the factor C to take into account the proportion of cullet in the batch are given in Table 3. These are for an average glass composition such as would be used for containers or sheet glass. The factor does not vary as much with glass composition as one might expect because the bulk of the heat requirement is a function of the specific heat of the glass. The relative error ordinarily is insignificant as long as two radically different types of glass are not compared.

Effect of Color of Glass

One of the objections to the method is the difficulty of taking into account differences in the transfer of thermal radiation through high iron glasses, amber colored glass and so forth. Furnaces melting amber glass or high iron glass may consume 10 per cent less fuel than for clear glass. This is unimportant as long as furnaces mak-

TABLE 2

ADJUSTED AREAS, M, FOR CORRECTION OF FUEL CONSUMPTION TO EQUIVALENT FOR A FURNACE OF 600 SQ. FT. AREA

10-200 sq. ft.			200-1000 sq. ft.			1000-5000 sq. ft.		
A	M	Diff. for 1 sq. ft.	A	M	Diff. for 1 sq. ft.	A	M	Diff. for 1 sq. ft.
sq. ft.			sq. ft.			sq. ft.		
10	58		200	304		1000	840	
		2.6			0.88			0.55
20	84		250	348		1200	950	
		2.0			0.82			0.55
30	104		300	389		1400	1060	
		1.8			0.76			0.50
40	122		350	427		1600	1160	
		1.5			0.74			0.50
50	137		400	464		1800	1260	
		1.5			0.72			0.50
60	152		450	500		2000	1360	
		1.4			0.68			0.46
70	166		500	534		3000	1820	
		1.3			0.66			0.44
80	179		550	567		4000	2260	
		1.2			0.64			0.44
90	191		600	600		5000	2700	
		1.2			0.63			
100	203		700	663				
		1.1			0.61			
120	226		800	724				
		1.0			0.59			
140	246		900	783				
		1.0			0.57			
160	266		1000	840				
		1.0						
180	286							
		0.9						
200	304							

ing clear glass are not compared with those making colored glass.

Effect of Age of Furnace

As a furnace gets old its fuel consumption gradually increases because the sidewalls wear and become thinner, thereby transmitting more heat to the outer furnace walls. It is essential, therefore, to compare the performance of furnaces at equivalent ages, or after equivalent tonnage outputs.

For colorless glass, the performance quotient of a new furnace fired by natural gas or oil may range from 4 to 7 B.T.U./sq. ft./sec., with an average value of the order of 5.0 B.T.U./sq. ft./sec. for conventional, well designed and operated bridgewall type furnaces.

Example of Calculation

Data Available	Area	Ave. Temperature by Optical Pyrometer
Bridgewall Tank, Melting End	520 sq. ft.	2750°F.
Working End	166 sq. ft.	2380°F.

Fuel Consumption—700,000 cu. ft. natural gas in 24 hours.
Tons glass produced—100 tons day.
Heat Value of fuel—1048 B.T.U. gross, 945 B.T.U. net.
Percent Cullet in batch—20 per cent.
Age—68 days.

$$Q = \frac{1.16}{M}\left[\frac{G}{K} - CW\right]$$

$$G = \frac{700{,}000 \times 945}{100{,}000} = 6615 \text{ therms/24 hrs.}$$

$$W = 100 \text{ tons/24 hrs.}$$

From Table 1) K at 2750 = 1.142
From Table 1) K at 2380 = 0.890

$$\text{Ave. } K = \frac{(520)\ (1.142) + (166)\ (0.890}{686} = 1.081$$

From Table 2) M for an area of 686 = 654
From Table 3) C for 20% cullet = 30.69 therms
Accordingly

$$Q = \frac{1.16}{654}\left[\frac{6615}{1.081} - (30.69)\ (100)\right]$$

$$Q = 5.41$$

Increase of Fuel Consumption With Age of Furnace

It is well known that the fuel consumption of a continuous tank furnace increases as the tank becomes older. This is often erroneously blamed on the clogging of the checker chambers which takes place gradually throughout a furnace campaign. However, in many cases where checkers have been reset during the course of a campaign, operability has been restored and stack draft made adequate to hold the furnace pressure down to the desired low positive values, but in no such case have the authors ever observed that fuel consumption decreased or that flue gas temperatures in the outgoing conduits were lowered after the checker change. Actually, the increase in fuel consumption with age is due primarily to the progressive thinning of the sidewall blocks due to corrosion by the molten glass, although the necessity of intensified air or water cooling frequently plays a part.

TABLE 3

HEAT REQUIREMENT FOR CORRECTING FOR TONS OF GLASS MANUFACTURED

% Cullet	J (net therms/ton)	(C (net therms/ton)
0	20.0	32.31
10	19.5	31.50
20	19.0	30.69
30	18.5	29.89
40	18.0	29.08
50	17.5	28.27
60	17.0	27.46
70	16.5	26.66
80	16.0	25.85
90	15.5	25.04
100	15.0	24.23

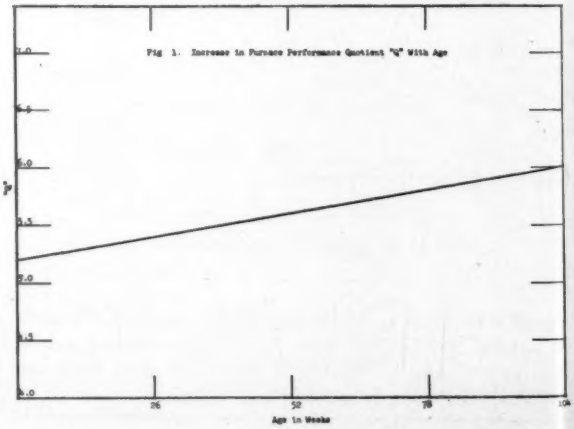
This table gives values of C based on use of natural gas burned with a thermal efficiency of 0.619. For other values of thermal efficiency the quantity of C can be found by dividing J by the actual thermal efficiency. The per cent of cullet refers to the percentage of the melted glass that is derived from the cullet.

The increase in fuel consumption with age may for all practical purposes be considered as taking place at a uniform rate, if the average rate of tonnage production is reasonably uniform throughout the campaign. Figure 1 indicates the increase in the Q value of a bridgewall tank with age. Although the points from which the line was plotted are not shown, all of them fell reasonably close to the line, which may be expressed by the equation.

$$Q = 5.2 + 0.008\,t$$

where t is the age of the furnace in weeks

Gould[3] has recently published a comprehensive sum-



mary of the factors that influence the variation in Q value with furnace age, along with tables and charts for calculating the magnitude of the effects of these factors. For the purpose he defines the aging factor as "a" in the expression

$$Q = Q_o (1 + at)$$

where Q_o is the value at zero age and t is the age of the furnace in weeks.

The increase in fuel consumption and hence in the Q value with age was assumed to depend on (1) Operating temperature, because the rate of solution of a refractory is known to increase rapidly with the temperature increase. (2) The type of refractory block employed. Some blocks, such as Corhart, Zac and Monofrax, are much more resistant to corrosion than fireclay block, but they are also much better heat conductors. (3) The size of the tank, because the increase in hearth area as the blocks wear is relatively much greater for small tanks than for large ones.

From data on a number of tank furnaces in which changes had been made in one or more of the elements affecting aging, Gould derived data permitting generalizations to be made for the magnitude of the effects. His findings are summarized below, omitting the computations and theory.

Effect of Temperature and Furnace Area

The effect of temperature on the aging factor "a" was found to vary with the furnace area as was expected. It can be established from the expression,

$$\log a = 3.94 - \frac{B}{T}$$

where B is a function of the melting area of the furnace.

(In the original work of Gould, the constant B and the temperature T were expressed in Centigrade temperature units. For convenience, these have been converted to their nearest Fahrenheit equivalents absorbing the bothersome 32° correction in the process. The error in so doing is not significant.) Values of the constant B may be obtained from Fig. 2.

The fundamental aging factor expression was set up using Corhart block as standard. For sillimanite block, or its fireclay equivalent, the calculated "a" requires to be increased, whereas for Zac block it needs to be decreased. Appropriate multiplying factors are,

For Sillimanite block	1.56
For Standard Corhart	1.00
For Zac block	0.64

Correction for Initial Value of Q

It was found that the factor "a" was not entirely independent of the initial value of Q because of the effects of differences in the thermal conductivity of the blocks. The effect is a very small one but when required may be obtained from the expression.

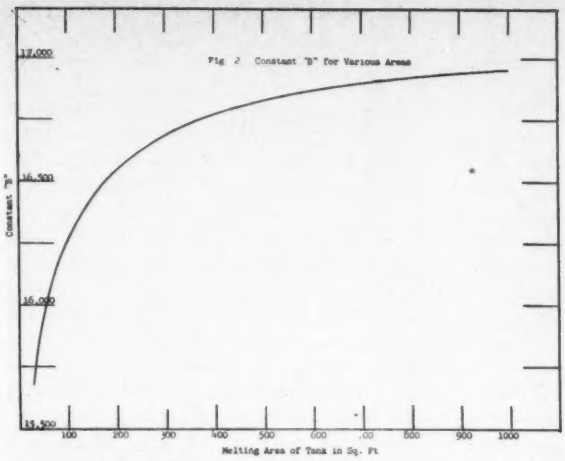
Correction to "a" for magnitude

$$\text{of initial Q value} = \frac{0.005}{Q_o} - 0.001$$

which is to be added to the calculated value of "a".

Effect of Iron Content of Glass

As was pointed out previously, glasses containing higher amounts of iron require less fuel for melting at a given rate for the same operating temperature than do glasses containing lower amounts.



Gould found that the effect of iron content of the glass on the aging factor could be expressed by the following expression,

$$d = (0.035 - x)\ p$$

where "x" is the per cent Fe_2O_3 in the glass and "p" is taken from the curve, Fig. 3.

Effect of Depth of Glass in Tank Furnace

The standard depth is taken at 2 ft. To correct "a" for other depths, multiply by

$$R = m - nA$$

where A is area in square feet and "m" and "n" are taken from Table 4.

A plot of the values of q against time indicated that the age factor "a" was approximately 0.0040. The calculated factor "a" is found as follows:

(A) From curve, Fig. 2, "B" for 238 sq. ft. = 16.605

(B) $\log a = 3.94 - \frac{16.605}{2543} = 3.94 - 6.530 = -2.590 = 7.410\text{-}10$

$a = 0.00257$

(C) Adjusting for sillimanite blocks

$a = 0.00257 \times 1.56 = 0.00401$

(D) Adjusting for $Q_o = 4.48$

$a = 0.00401 + \left(\frac{0.005}{4.48} - 0.001\right) = 0.00401 + 0.00012$

$a = 0.00413$

(E) Adjusting for Fe_2O_3 Content of 0.06%

From curve, Fig. 3, p for 238 sq. ft. = 0.00479

$d = (0.035 - 0.060)\ 0.00479 = -0.025 \times 0.00479 = 0.00012$

$a = 0.00413 - 0.00012$

$a = 0.00401$

(F) Adjusting for 3-foot depth

$R = 1.056 - 0.000037 \times 238 = 1.0472$

$a = 0.00401 \times 1.0472 = 0.00420$

The calculated value differs from the experimental value by about 5%. The difference is probably due to

(*Continued on page* 284)

LIFE BEGINS AT 52— FOR HOUZE

No one three years ago would have made the prediction that the quiet, 52-year old L. J. Houze Convex Glass Company, Pojnt Marion, Pa., would soon be producing a fine line of tableware, entering the highly competitive billion dollar greeting card field, making face plate and implosion plate glass for television sets, and entering the retail field with a gift line—all under its own trademark.

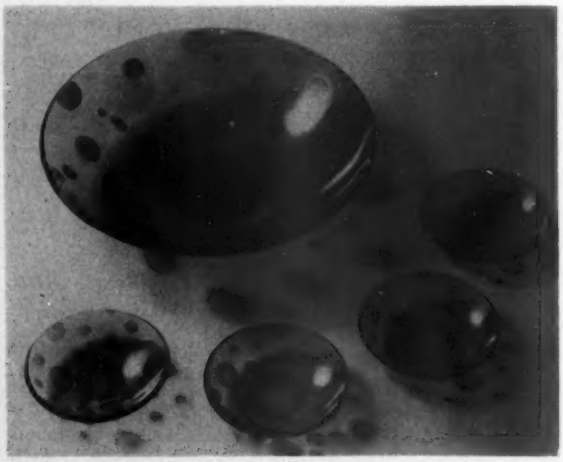
In 1951, Houze was making a comfortable living as a supplier of 75 per cent of the sun glass lenses made in the U. S. The smaller portion of its sales dollar came from private mold work—hand-pressed ware for lamp parts, ash trays and the like; some technical glass including microscopic cover glass, cased opal glass for lighting fixtures and X-ray viewing screens. All were by-products and marketed through other brand name manufacturers and jobbers. They are examples of a rare craftsmanship that is now being expanded for brand new markets.

In the fall of 1952, the Board of Directors, aware of the trend towards diversification in the post-Korea adjustment period, decided it was unwise to predicate the future existence of the company upon a single product, even though civilian sun glass sales were soaring and the lens role for Houze still looked like a major one in the immediate years ahead. The quick listing of the new Houze product lines in the current glass directories doesn't begin to convey the surge and excitement sweeping the company where new developments in colored glass are coming to light almost daily.

No one, perhaps, is more excited, and rightly so, than the man responsible for this sudden growth. E. V. Ogg, the new chief executive officer, arrived at Houze 20 months ago. In making an extensive audit of the company's manufacturing assets, Mr. Ogg was immediately impressed by its team of expert craftsmen, many of whom inherited the skills and artisanship that Leon J. Houze, Sr. brought to the area in 1893.

It was immediately apparent to Mr. Ogg that such precious talent, so rare in colored glass manufacture, should be utilized in other fields. The seven Fourcault machines that were drawing glass around the clock for the sun glass industry offered a number of product possibilities. Here was Houze colored glass at its finest—rose smoke, amber and green and blue in a variety of shades. Behind this basic line was a reservoir of 700 colored formulas to draw from. Made thicker, the glass could be cut or bent into any shape or size and delicate, ceramic designs, either through the decalcomania or silk screen process, could be fused permanently into the glass.

Example of Houze entry in the premium field is the colorful ash tray produced for Santa Fe's Super Chief. The ash tray is being used as a souvenir to passengers patronizing the famous Turquoise Room.



Available in 100 leading department stores across the country is a line of informal servicing accessories, including this attractive salad bowl set made up in Twilight and amethyst colors.

An artist was engaged to do a Christmas design for reproduction on a sheet of opal glass. The result was a Christmas card that could be used as an ash tray or coaster (THE GLASS INDUSTRY, May 1953). The "card" was mailed to several hundred companies and enclosed was a miniature reproduction of a paper greeting card made in 1842 which contained this message: "This is the first Christmas card ever made . . . and here is the first Christmas card in glass."

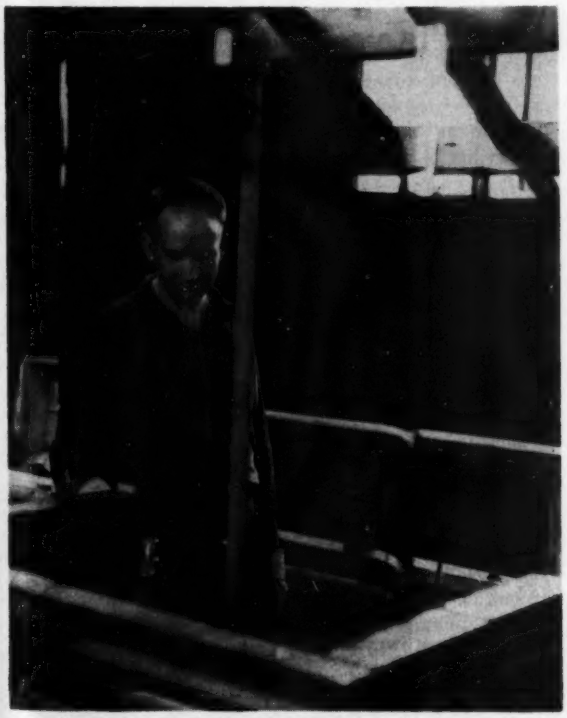
Letters poured in requesting designs for 1953. Soon Houze had its own art department and turned out its first greeting card line. Following distribution of a full-color catalog, the company found itself in the direct-mail business, filling quantity orders for such firms as the Baltimore & Ohio Railroad, Encyclopedia-Brittanica and others. Although no plans were made to enter the retail field last year, interest in the novelty spread fast to the consumer level as a result of the publicity. Last November, "Houze-Art" glass Christmas cards, retailing around $2.00, four to a set, were sold in such leading department stores as Nieman-Marcus, Lord & Taylor, W. & J. Sloane and 91 others located in 65 large cities throughout the country.

The cards had multiple sales value. For example, a number of stores sold them at both the stationery counter and at the special-gifts section on the main floor. So successful was the Christmas card debut that Houze is out this year with greeting cards for anniversaries, birthdays and Mothers Day. The cards can be individually gift-wrapped in a sturdy chipboard carton and mailed at low fourth class rates.

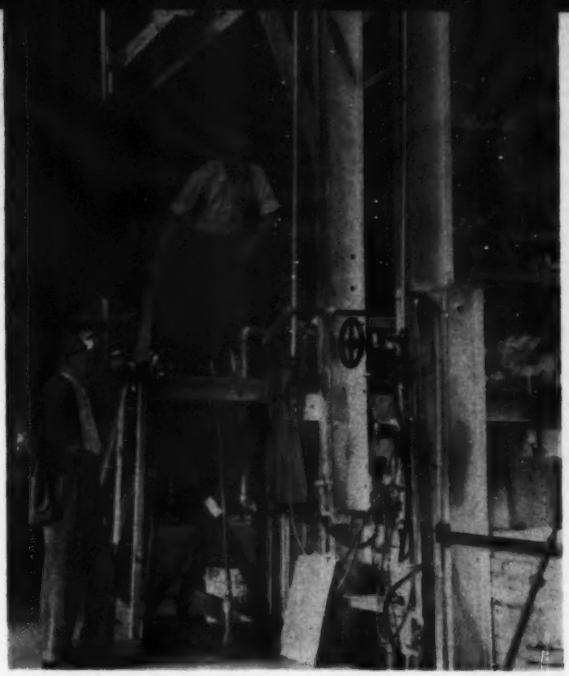
Encouraged by the acceptance of its tailor-made designs featuring company trademarks on the holiday cards, Houze plunged into the lucrative premium field. The art department turned out a hundred new sample trays and coasters in a variety of colors and designs and shipped them off to New York for the National Premium Show. Although the name Houze was unknown to premium buyers, the company's booth was one of the busiest among the 300 veteran exhibitors.

Today, firms like Socony-Vacuum Oil Company, Johnson's Wax, Allied Steel, Santa Fe Railroad and others are using Houze glass as goodwill gifts, incentive awards and as advertising specialties. Socony blended their famous Flying Red Horse with a reproduction of an early American car, gift-packed the trays, four to a set, and distributed them as incentive awards to their dealer salesmen. In the past Socony had used a variety of premium ideas with much success, but was unprepared for the popularity of the Houze ash tray. When wives of the dealers began to put the trays to use in the living room, friends and relatives called Socony to see if they could be purchased outright. "When people put your trade mark in the living room, what more can you ask of a premium?" asks Mr. Ogg.

Last summer when the company announced that after



Kenneth Powell, Cutter, stands before a large sheet of glass just prior to cutting. Note absolute clarity looking through this glass from which television face plates are cut.



E. V. Ogg (left), Executive Vice President and General Manager of the Houze company, looks on as H. O. Scott, Production Superintendent, examines new tank used for melting new television glass.

eight years research their technologists finally developed a neutral grey sun glass lens that could be chemically controlled for mass production for the popular-priced market, they were actually bringing out a new colored glass that was to have wide application in several new fields. The neutral glass, called "Natural View" because it does not distort color perception when you look through it, is now playing a major role in the new product program. From a newly constructed tank, the neutral glass is now being drawn in varying degrees of densities and thicknesses for television sets. The glass not only cuts down reflected glare for the viewer, but it is said to be more restful on the eyes. The research department is already at work developing a neutral glass for color television which is expected to be an even bigger market potential.

Also, the company is at work producing a new neutral window glass which will have its first use in a new school building in Los Angeles. The glass, which will cut out as much as 90% of the sun's glare, will be installed as "vision strips" 18 inches high above the window sill at eye level. Architects who have seen samples of this new glass predict many uses in homes and offices.

The use of the neutral color in new glass products seems virtually limitless. After several leading home decorators saw the glass under artificial lighting conditions, they were impressed with its possibilities in a gift line. On April 1 Houze entered the tableware field for the first time with a new line of colored glass serving accessories. The initial line includes large salad bowls with matching service sets; bon bon dishes, serving trays and hors d'oeuvre plates in round, square and free form shapes with deep and shallow bends. They were shown to buyers for the first time at the recent New York Gift Show through the Vincent Lippe Company, 225 Fifth Avenue, New York. The feature of the casual serving accessories is the new range of colors and shapes. New

(*Continued on page* 284)

SELECTION, INSTALLATION AND OPERATION OF WOVEN WIRE BELTS FOR THE GLASS INDUSTRY

By JOHNSTON F. REID

The Cambridge Wire Cloth Company, Cambridge, Maryland

Introduction

Lehr temperatures and lehr speeds being definitely on the increase, and with production schedules on a "round the clock" basis, it becomes increasingly important that woven wire belt users have complete facts regarding the selection, installation and operation of this important production tool.

Woven wire belts aren't complex. But pick the wrong specification or weave of the wrong type of wire, do a sloppy installation job, and you may run up a whole string of complexities—including lost production, short belt life, high fuel costs and a host of others.

Selection

The three "R's" on woven wire belt selection are:

The "R"ight construction.
The "R"ight metal or alloy.
The "R"ight installation and maintenance.

The "R"ight Construction

No one belt construction will give complete satisfaction under all operating conditions. Each construction has individual characteristics that render it most useful to certain applications. Therefore, successful and satisfactory woven wire belt engineering requires thorough coordination of specific service requirements, as well as the requirements of the ware to be handled, size of mesh or opening desired, and size of wire and material of which the belt is to be woven. Although there are nine basic woven wire belt constructions, only four are in general use in the glass industry—Balanced, Gratex, Duplex and Double Balanced. Here is how these four differ one from the other.

The Balanced construction is the most popular for use on annealing and decorating lehrs. The characteristics of the Balanced Belt are: low ultimate cost, high tensile strength, straight belt travel and resistance to distorting strains. The primary feature in the construction of the Balanced Belt is that it eliminates all tendency to creep to either side of the drive pulley. At the same time, it balances operating stresses to prevent them from growing into localized distorting and destructive strains.

The Gratex construction is similar to the Balanced Belt, except that the spirals are more closely wound to produce a semi-closed mesh. Thus, it retains the advantages of the Balanced weave but, due to the proximity of the mesh, a stronger construction is provided. The Gratex Belt is next in popularity to the Balanced Belt for annealing and decorating work. The finer meshes are used mostly to handle small ware. The heavier specifications are sometimes called upon for operations demanding a close smooth mesh and a belt construction with high tensile strength for heavy loads.

The characteristics of the Duplex construction are: high tensile strength, closest mesh, smooth carrying surface, greatest density, most compact structure, straight travel. It is used mostly on feeder lines transporting ware from mold machines to lehrs.

The Double Balanced construction is similar to the Gratex belt except that there is a greater angle to the weave. This increased angle permits larger opening in the mesh than can be obtained with the Gratex weave.

Annealing and Decorating Belts. Undoubtedly every known type of belt construction has been tried on glass annealing and decorating lehrs with the result that this industry has today practically standardized on the Balanced construction in the following specifications:

B-58-22-14	B-36-20-12	B-24-25-10-12
B-42-27-14	B-42-18-12	B-18-16-11-12
B-36-41-14	B-24-27-12	B-18-17-10

In these specifications, the first number indicates the number of spirals or loops per foot of belt width; the second, the number of cross rods per foot of belt length; the third, the gauge wire used.

For belt operation in annealing lehrs at temperatures between 800 and 1,000 degrees F. and under load conditions approximating 20 pounds per square foot of belt surface, the Balanced weave has the necessary tensile strength for reasonable belt life.

If a higher factor of safety is desired, the use of a Gratex belt is suggested. The Gratex belt constructions are being successfully used where the hazards of operation warrant increased belt weight, such as in the older types of lehrs, for carrying heavier than usual loads, operating at increased belt speeds, etc. The following Gratex specifications are recommended:

G-60-38-14 G-43-20-10-12 G-43-30-10-12
G-50-36-12-14

"Long Pitch" Spirals. The trend in lehr belt selection is toward the modern "long pitch" spirals. The "long pitch" spiral offers several advantages over the older belts that have been used in the past. The two most important are: (1) Increased tensile strength with insignificant increase in weight. Greater tensile strength in a belt means greater load capacity and higher speeds with no major increase in heating costs. (2) Smoother, more uniform surface with approximately the same percentage of open area. A smooth belt surface is better suited to mechanical loading and will handle a larger assortment of sizes and types of ware.

The tensile vs weight ratio is best illustrated by a comparison of two specifications of the Balanced construction, Specification B-24-27-12, the older model, and Specification B-36-20-12, the newer " long pitch" model. The new construction has only 20 crimp rods per foot of length as compared with 27 in the older construction. However, the number of turns across the width of the belt has been increased to 36 from 24. The following figures give a direct comparison of weight and tensile

strength between the old type Balanced construction and the newer "long pitch" Balanced construction:

Weight per square foot

Old type (B-24-27-12)	3.50 lbs.
"Long pitch" (B-36-20-12)	3.63 lbs.
Total weight increase	3.71%

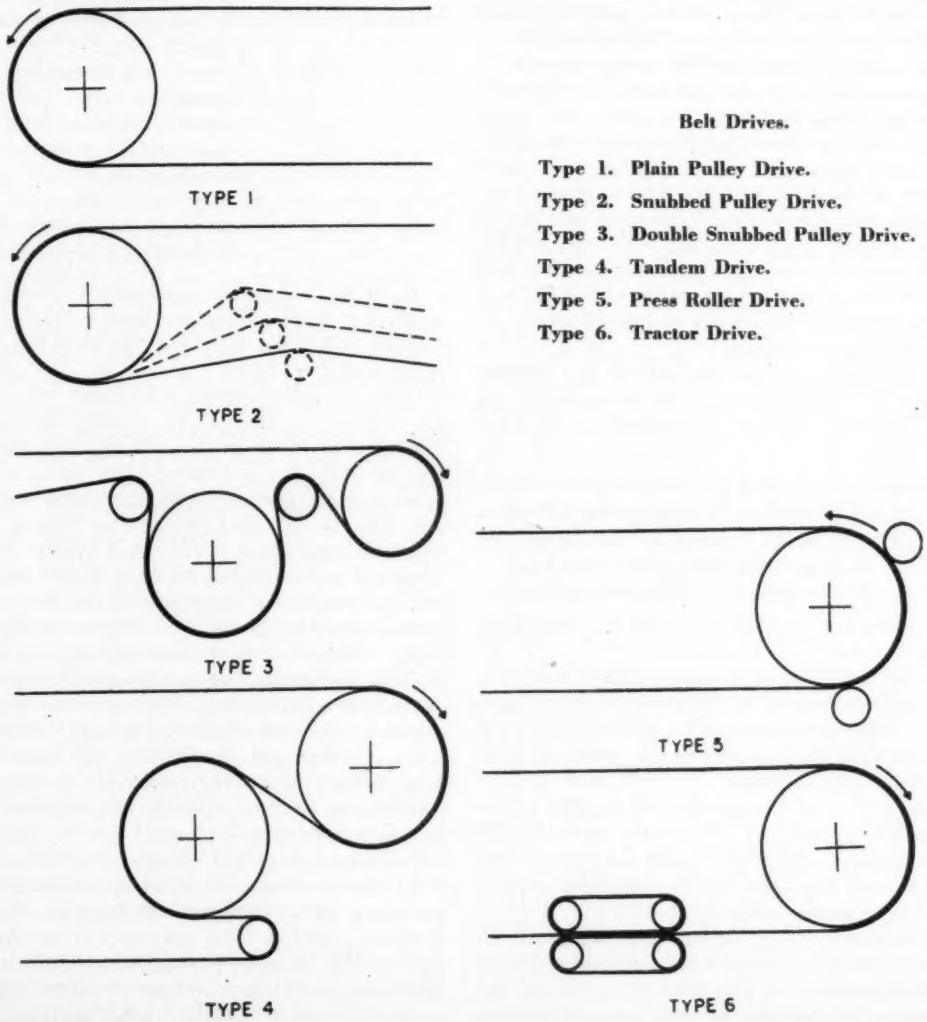
Tensile strength

Old type (B-24-27-12)	25,200 lbs.*
"Long pitch" (B-36-20-12)..	37,740 lbs.*
TOTAL TENSILE STRENGTH INCREASE	49.76%

With the emphasis on lehr belts of lower weight per square foot to reduce heating costs and improve annealing, and with the need for greater tensile strength to handle heavier loads and higher speeds, let us review a case history that points out convincingly the importance of sound woven wire belt engineering, as well as how the "long pitch" construction can prove advantageous over the older type.

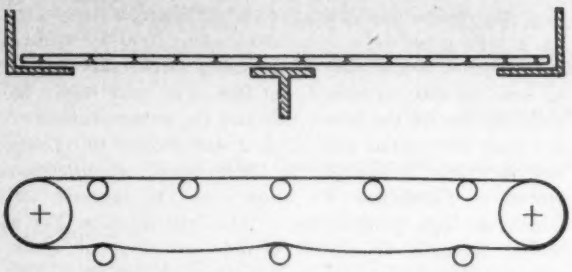
The major problem in this case was to reduce heating costs and the frequent replacement of heating elements. The job was to anneal quarts and half gallon containers on a high speed lehr at approximately 1050°F. Gratex specification G-43-30-10-12 had been satisfactory as far as belt life was concerned, but fuel costs were high. As the load was on the heavy side and the temperature near the limit for regular steel wire, it was decided to try one belt in Spec. B-36-19-12, a "long pitch" specification woven of Cambriloy #1 alloy wire (to increase the tensile at high temperature). This specification has a tensile strength of 37,740 pounds per foot of width (woven of steel wire at room temperature) against 45,120 pounds for G-43-30-10-12. The weight of B-36-19-12 is 3.63 pounds per square foot or 46% less than G-43-30-10-12. It was reasoned that with a 46% reduction in weight against a 16⅓% reduction in tensile strength and, with the added safety factor of the low chrome alloy wire, the factors in favor of the change in specifications more than out-weighed those against.

The belt was installed and, after 18 months operation, had resulted in appreciable savings in fuel costs alone, plus a sharp reduction in element replacement and a better annealing job. The lower belt weight permitted a higher belt speed which resulted in still lower operating costs. This factor was not considered when the final cost



Belt Drives.

Type 1. Plain Pulley Drive.
Type 2. Snubbed Pulley Drive.
Type 3. Double Snubbed Pulley Drive.
Type 4. Tandem Drive.
Type 5. Press Roller Drive.
Type 6. Tractor Drive.



Belt supports used on practically all annealing and decorating lehrs. The rollers are spaced from 8 to 12″ centers, depending on the load and type of ware the belt is handling.

analysis was made. The most surprising factor of this case history is that belt life was more than doubled over the older specification. Far from it. Hundreds of these older specifications are now in service and all are doing a good job. Specifications like B-24-27-12, B-24-25-10-12, G-60-38-14, etc., have proven their worth over the years and will continue to be popular for many years to come.

Feeder Belts. Although annealing and decorating lehrs represent the widest use for wire mesh belts in the glass industry, this type of belting is becoming more and more popular for feeder lines. These are the narrow belts that move the ware from the forming machines to the lehr.

There are several reasons why the woven wire belt is gaining in popularity for feeder belt work. The first and most important is long and satisfactory life. The second is that they reduce checking and are easy to keep clean. Third, they are connected or disconnected quickly and in the same manner in which they are woven, thereby making the truly seamless belt. Fourth, they can be obtained in a variety of mesh and gauge sizes. Fifth, they are less prone to damage by broken ware. These are the most important advantages of the woven wire belt for this type of work. But let us review an actual case history as reported by a large glass producer.

"In our glass plant, we have and still use two different material belts for conveying ware from our machines into our lehrs. These materials are (A) Asbestos; (B) *Metal* (Wire).

Cost... (A)...6″ width @ $1.33 per running foot.
8″ width @ $1.80 per running foot.
(B)...4″ width @ $2.45 per running foot.
6″ width @ $2.55 per running foot.
** 8″ width @ $2.50 per running foot.

** Cost is adjusted, as weave and wire size differ from others.

"In view of the above cost figures, the 6″ belting is 92%, and the 8″ belting is 39%, higher for wire. However, this is only the initial cost comparison. We have more pertinent information to add to this statement, insofar as wire belting is concerned.

"Incidentally . . . the 4″ conveyor belting is in a category of its own, as we do not believe that material made of the (A) product would be durable enough to withstand the treatment encountered. (This statement is based on our own past experience.)

"According to our records, we can safely state that the wire conveyor belting is far more durable than any other material belting tried in our plant.

"In regard to the length of operating time, we can state that the wire conveyor belting stays in operation on an average (throughout our plant, including all conditions) of three to one longer than that of the (A) product.

"More important . . . the wire belting does not have a tendency to retain oil films on the surface. Providing a slight oil film should appear, it can easily be dried away. (This is very important as perfectly dry conveyors are essential where hot glass is concerned.)

"We feel that wire conveyor belts are far superior in all respects, and it is inevitable that within the near future all our conveyors will be equipped with wire belting.

"We have based our thoughts and opinions on facts, and the facts were obtained in our plant during the past several years of various trials of belting assortments that include different blended materials and numerous metal belt weaves. Also close consideration has been given in regard to hazardous confronting problems that involve our finished product where the relationship of conveyor belting is concerned, and after obtaining the total analysis of our findings, we deemed it a necessity to move strongly in favor of the wire belting.

Summary:

Metal belting....Will not absorb oils or greases.
" " ....Is 3 to 1 more durable.
" " ....Is less conducive to shrending hot glass.
" " ....Cost is less through savings of lost production time due to replacements of various beltings that become at fault more rapidly.
" " ....Is exceptionally easy to keep perfectly dry, if desirable.
" " ....Requires no foresight from a protective angle, if placed inactive.

There are five popular specifications that are used for feeder belt work. These are Duplex Spec. 7-16, Gratex G-69-60-14-16, and Balanced Specifications B-70-56-16, B-60-55-16, B-42-27-14.

Other types of Balanced and Gratex belting and a few specifications of Duplex are used for feeder belt work. The selection of the proper belt depends entirely on the type of ware to be handled. One thing is important. Some manufacturers of forming machines specify that the belt must be ¼″ thick because the cooling plate from which the ware moves to the belt is slightly over ¼″. For successful transferring of the ware, the belt surface should be a little under the top surface of the plate.

Other Uses for Woven Wire Belts in the Modern Glass Plant. The use of woven wire belts in the modern glass plant is not confined to annealing and decorating lehrs or to feeder lines alone. Their use and versatility has spread to other jobs that were thought impractical a few years ago. And with "automation" the by-word of American Industry, it is only reasonable to expect that this rugged, low cost and versatile belt will find even more jobs to perform as time passes.

Cullet conveyors and washers are now using woven wire belts for better, all-round operating efficiency, and are saving money and time in the bargain. Wire belts are now being used as cross conveyors at the charge end of lehrs with good results in terms of reduced checks. Other plants are now using wire belts on carton conveyors and are finding that longer life is received. They are easy to

keep clean and less prone to damage. Also, some plants are installing wire belts on take-off conveyors at the discharge or inspection end of lehrs.

One of the most unusual and successful installations under the heading of "special jobs" is the multiple lehr for decorating pharmaceutical tubes. A large producer of this type ware was faced with the problem of increasing production and at the same time reducing rejects. A survey proved that one of the big bottlenecks was the loading of the lehr. Extra care in placing the ware on the lehr belt was necessary and even then the fresh colors would smear, thus producing a high percentage of rejects.

After considerable time and experimentation, it was finally decided that a multiple lehr was necessary. This lehr consists of six narrow wire belts of rod-reinforced construction with duplex selvage to reinforce the edges and special cleats to keep the freshly colored tubes from rolling on the belt and smearing the color.

The narrow belts are driven from a common drive and each has its own adjustable take-up. By staggering the length of the belts, each has its own loading station next to a decorating machine, thus eliminating costly handling. Also, full advantage is obtained from the lehr's width which means that capacity has been increased without increasing floor space. This installaion has been so successful that production has increased 20% and rejects reduced to practically nothing.

Another interesting and successful installation where woven wire belts were brought into play is on a mold cleaning conveyor being used by one large glass producer.

Molds for the glass shapes must be thoroughly cleaned between each using. To accomplish this, many glass molders use a sand blast machine. Handling the molds individually through the blasting operation becomes a cumbersome problem, which one manufacturer has solved by installing a Gratex Belt, Spec. G-35-21-6-10. This belt is 18 inches wide and serves as the medium for carrying the molds past the fixed sand guns. Only one operator is required to turn the molds as they pass through the barrage of sand so that all surfaces are thoroughly and quickly cleaned. Sand and dirt particles from the mold fall freely through the mesh openings of the belt. Day after day, handling loads up to 50 pounds per square foot, this belt is giving satisfactory service under the most arduous operating conditions.

The "R"ight Metal or Alloy

It is of primary importance for longest belt life that the belt be constructed of the proper metal or alloy to meet the operating conditions to which the belt will be subjected. The most satisfactory installation and the longest belt life will be obtained only when the requirements of the service, the belt construction and the selection of metal or alloy are properly coordinated.

Internal operating stresses are very active in belts operating under temperatures as high as those in annealing and decorating lehrs. Thus, it is very important that the belt construction be of sufficientt strength and of the proper character to hold these internal stresses in check to delay as long as possible the development of destructive strains.

For glass annealing between 800°F. and 1050°F., plain .10 to .12% carbon steel is not satisfactory. Steel with higher carbon content and with a higher manganese content than standard carbon steel should be used to provide sufficiently high mechanical properties and a good factor of safety. Some glass plants, in order to increase production, have raised annealing temperatures to 1100°F., and have increased belt speed accordingly. These conditions require an even greater safety factor, and in such cases a 1% chrome or an aluminum alloy surfaced steel is recommended.

A 1% chrome alloy steel acquires a tightly adherent protective scale when subjected to operating temperatures between 800 to 1100°F., and has excellent mechanical properties within this range. It is resistant to both progressive surface oxidation or scaling and intergranular oxidation. Its greater strength at the operating temperature makes it particularly suitable for heavy loadings.

For extended belt life in the range of 1200 to 1300°F., a 3% chrome alloy should be used to meet the more severe effects of longer time at higher temperatures. A 3% alloy offers a special analysis of chromium, silicon and molybdenum. It provides a stable and balanced alloy, high creep strength, high rupture strength and high structural stability up to 1300°F. It also provides excellent oxidation resistance up to 1400°F., and resistance to embrittlement over long-time heating. At a price permitting its use in glass decorating lehrs, a 3% chrome alloy steel approaches the expensive "stainless steels" in these physical properties.

In summary, the following data may be used for preliminary selections of specific materials of belt construction. Final selection, of course, should be made only with the guidance of an experienced wire belt engineer.

Low Carbon Steel Wire: For ordinary work, under dry conditions, a steel of about .10% to .12% carbon is commonly used. This analysis is easy to work, makes a ductile weld and provides a good mechanical strength. It is a suitable analysis for dry operations up to 400° or 500°F.

HC Steel is a special analysis carbon-manganese steel developed for glass annealing lehrs operating in the range of from 800° to 1000°F. Its higher manganese content combines with the carbon in proper proportion to provide the needed retention of strength over the recommended temperature range. This wire makes a strong and ductile weld and has proven so satisfactory for glass annealing lehrs that it is the standard analysis for this use.

1% Chrome Alloy Steel Wire: For this same annealing range of 800° to 1000°F., and up to about 1200°F. in glass decorating, Cambriloy 1 Alloy Steel is a special analysis chromium-molybdenum alloy steel, with increased carbon accentuated by the chromium and toughened by the molybdenum. It provides a toughened steel with increased strength at elevated temperatures up to 1200°F., good weldability and improved oxidation resistance at a small increase in cost over basic carbon steel. It is superior to the .40% to .50% plain carbon steel in weldability, toughness, strength at elevated temperatures and high-temperature oxidation resistance.

A 2% Chrome Alloy Steel Wire is intermediate in properties between Cambriloy 1 and Cambriloy 3 Alloy Steels.

Aluminum Coated Steel Wire: The aluminum-steel alloy surface of Cambriloy AL offers an unusually high degree of resistance to progressive oxidation, and heat scale

in temperatures up to 1200°F., thus lengthening belt life and reducing red iron oxide markings. Cambriloy AL retains its initial strength longer than steel. It possesses a high degree of heat reflectivity throughout a wide range of elevated temperatures. The aluminum-steel alloy seal resists the attack of sulphur or carbon gases, which quickly corrode carbon steel wire.

A 3% Chrome Alloy Steel Wire was developed specially for glass decorating lehrs to meet the severer operating conditions of increased temperature, longer high-temperature zones and high belt speeds. It provides greatly increased strength at temperatures up to 1300°F., with greatly improved oxidation resistance up to 1400°F., as well as excellent structural stability over long periods of high-temperature operation. At a price permitting its use in glass decorating lehrs, it provides properties of toughness, resistance to embrittlement in service, strength at elevated temperatures, and oxidation resistance superior to the 4% to 6% chromium steels and approaching the expensive "Stainless Steels".

The "R"ight Installation and Operation

The third "R" of woven wire belt selection for the glass industry is: "The 'R'ight Installation and Maintenance". Here are a few tips on this important subject.

The Conveyor. A belt with a pair of terminal pulleys and the intermediate supports constitutes the conveyor. While too much stress cannot be made upon the care that should be used in selecting the belt, it is of equal importance that the same care be used in equipping the other parts of the conveyor. There is a close relationship between belt life and conveyor design, and therefore any study on belt operation rightfully includes a resume of the auxiliary equipment.

It is important that flexure of the belt occurs only at the hinging point of the individual spirals. Therefore, it is necessary that all pulleys and rollers that lift or lower the belt from a horizontal plane should be of sufficient diameter to prevent flexure of the metal itself. Repeated bending of the wire will develop "fatigue" failure of the metal, starting with minute cracks, working into larger ones and leading eventually to complete fracture and premature failure.

The amount of tension required to move a belt remains constant, but the driving strains can be reduced by increasing the frictional contact between belt and pulley. This is accomplished by increasing the diameter of the drive pulley or providing a snub roller. A further reduction in driving strains can be made by the use of a lagging on the drive pulleys. A good rubber lagging, or plastic material, may be used under normal conditions.

A woven wire belt is flexible longitudinally but is rigid across the width. Therefore, it is important that the terminal pulleys and supporting rollers should be of the "straight face" type. The use of "crowned" pulleys may result in a permanent deformation of the belt as the belt would tend to form around the contour of the crown, thus presenting a "cupped" surface.

Flanged supporting rollers are sometimes used but it is not advisable to provide flanges on the terminal pulleys. Experience has shown that they fail to accomplish the purpose for which they are intended. In the past they have been used to correct the travel of a belt, but it has been found that before flanges will stop side movement of a belt, the belt will climb up the flange and become distorted.

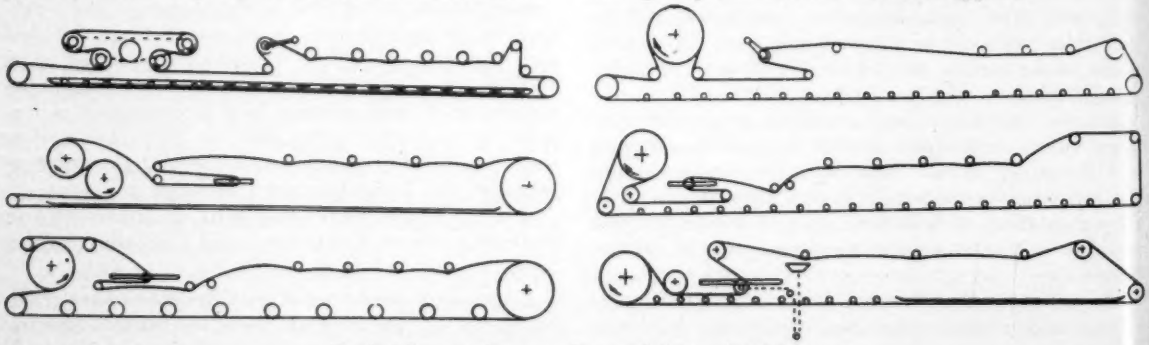
Unless the belt is of a narrow width and/or short length, intermediate supports are required to minimize both longitudinal and lateral sag. Narrow supports along the edges of the belt are satisfactory only for belts measuring a few inches in width. However, in practically all installations the support should engage the full width of the belt or intervals thereof. Otherwise, a flat carrying surface will not be provided and the belt may warp.

Installing the Belt. Too much stress cannot be laid upon the care that should be taken in starting off a new belt. The ultimate life is often predetermined by the attention that is given to a few details during the installation.

After checking the alignment of the two terminal pulleys and the snub and supporting rollers, the belt should be applied to the conveyor frame and made endless. The belt should then be run slowly with slack tension for a careful inspection of its entire length. Sometimes spirals become turned on edge in shipment or during installation and all such links should be flattened out before operating tension is applied.

After ascertaining that all individual spirals are properly seated, the travel of the belt should be observed and slight adjustments made when necessary. When the belt is properly aligned, the operating tension can be applied. The belt should then be operated for several hours without load, during which time further periodic checks of the travel can be made.

On annealing and decorating lehr belts, it is important that the heat be applied gradually until the desired temperature is reached. Invariably a change in temperature will affect belt travel, thus inspection of belt travel should be made as temperature increases or decreases. The belt should be operated at least ten hours at the operating temperature before the load is applied.



Typical layouts for annealing and decorating lehrs.

Aligning the Belt. Woven wire belts are so designed that they will run true when all rollers and pulleys are level and at right angles to the center line of the conveyor. While it is possible to make a conveyor with all rollers and pulleys in perfect alignment, it is not always possible to maintain such alignment during the entire life of the conveyor. Therefore, it is necessary from time to time to depend upon certain adjustments to insure proper travel of the belt. Adjustments should always be made on a "horizontal" plane, as "vertical" adjustments tend to produce an uneven tension that will "cross" the belt between the two end pulleys. Horizontal adjustments are controlled by *tension* or *deflection*.

Mesh belts will travel to a "short side" of a conveyor. Therefore, in correcting the travel of a belt, tension should be increased on the side of the conveyor toward which the belt is traveling or decreased on the side from which it is traveling. This applies only to horizontal adjustments on the head and tail pulleys. These adjustments are necessary on many installations, but their use is not always recommended. Continued operation with greater tension on one side than the other will result in lengthening the side of the belt on which the added tension is placed. A further disadvantage is that the lateral movement of the belt will be greater on the end of adjustment than on the end where the pulley is at right angles to the center line of the conveyor. This may cause the belt to assume a crosswise position between the head and tail pulleys.

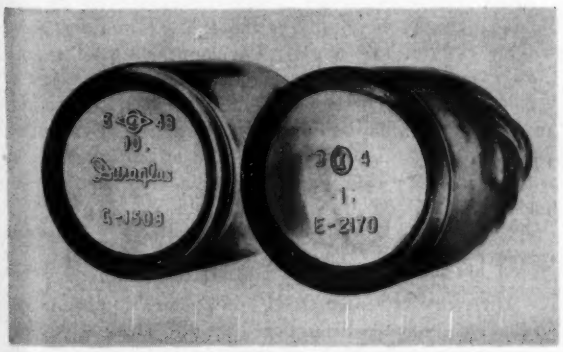
A mesh belt has a tendency to travel at "right angles" to the direction of a snub or supporting roller. Therefore, the direction of travel may be deflected by horizontal adjustment of the snub or supporting rollers. These adjustments apply only to those made in a horizontal plane on snub and supporting rollers. Most conveyors that are properly designed provide for a slack return on the mesh belt. Therefore, it is the return that can be most easily guided. Horizontal adjustment provided by an adjustable snub roller is the most effective and its use is recommended wherever possible. However, good results can be obtained by adjustment of the supporting rollers on either, or both, the return or carrying surface of the belt. The advantage of this type of adjustment is that the belt travel can be properly deflected without increasing tension on either side of the belt.

Care of the Belt. A belt should be run a number of hours at production temperatures without load to insure proper seating of the individual spirals and proper alignment of the belt. If the individual spirals of the belt are not allowed to seat and the belt is not properly aligned at the start, early and constant repairs may be expected and premature failure will result.

The life of a woven wire belt may be prolonged and its operating efficiency increased by periodic checkups. These periodic check-ups should include: (a) Inspection of the cleaning device; (b) Inspection of the temperature controls; (c) Inspection of all conveyor parts which come in contact with the belt; (d) Inspection of the belt, including a check on the alignment and minor repairs.

It is impossible to lay down fast rules for the operation of a belt as emergencies arise from time to time that would necessitate breaking any rules that may be set up. However, there are a few "tips" that should be kept in mind to get the most out of a belt. For instance, by maintaining a slack return, the travel of a belt is easier to control. Loading a belt evenly across the entire width eliminates the possibility of uneven belt strains which result in general distortion. Reversing a belt when the pulley contacting surface becomes worn prolongs the life of the belt. Keeping the belt in motion at all times while under heat eliminates the chance of burning an area of the belt, as well as preventing a contraction in width which is sometimes caused by a sudden start under temperature when the belt is frozen to the hearth.

A little care at the start and during operation will eliminate costly breakdowns and at the same time insure a maximum operating life.



OWENS-ILLINOIS MARKETING PROGRAM

Owens-Illinois Glass Company has embarked on a new marketing program that aims to improve sales by promoting the family relationship of its divisions and subsidiaries and the variety of products they make. The chief objective is to establish clearly in the minds of customers and potential customers what Owens-Illinois is and what it produces and supplies.

Until now, the company's three manufacturing divisions—Glass Container, Libbey and Kaylo—and its subsidiaries—Kimble Glass Company and Owens-Illinois Plywood Company—have marketed their products under their own divisional or subsidiary names with no concerted effort to relate them to the parent organization. The result was that many customers of one O-I division, in the market for other products, was unaware that they might also get these from Owens-Illinois.

To correct this situation, Owens-Illinois has adopted a common signature, already in use in all its advertising, which clearly establishes the parental role of O-I and identifies all products as O-I products. The signature consists of a new trademark—a bold O with an equally bold I in the center, as shown above—and the use of "Owens-Illinois" instead of the official name, Owens-Illinois Glass Company. By dropping the words "Glass Company", the new signature serves better the marketing of non-glass products, such as hydrous calcium silicate insulation, plywood and plastics which O-I makes. On checks, stock certificates and legal documents, however, the name Owens-Illinois Glass Company will continue to appear.

William J. Murphy, center, Vice President—Sales, and Peter Colefax, second from right, President, both of American Potash & Chemical Corporation, display handful of chemical salts from Searles Lake to, left to right, Joe Schumacher, President of Western Electrochemical Company; Glen Henning, Plant Engineer of Maywood Glass Company; and John Callinan, Plant Manager of Maywood Glass Company.

AMERICAN POTASH PLAYS HOST AT TRONA PLANT

Forty-four chemical industry representatives from the Southern California area made a one-day flying visit recently to the main plant of American Potash & Chemical Corporation at Trona, California. The Trona plant, located approximately 80 miles northeast of Mohave, produces a wide variety of industrial and agricultural chemicals from brine pumped from beneath dry Searles Lake.

During their visit, the chemical officials were told of the geology of the historically-important Searles Lake, formed thousands of years ago by cycles of flooding and drying up which left deposits that are believed to be the greatest natural stockpile of chemicals in the world.

Following inspection of the 30-square-miles dry lake, the chemical representatives made a tour of American Potash & Chemical Corporation's main plant to observe the process by which 750,000 tons of various chemicals are extracted from brine each year.

FOOTE MINERAL LITHIUM EXPANSION

The directors of Foote Mineral Company have tentatively approved further expansion of facilities for the production of lithium ores and chemicals, H. C. Meyer, Chairman of the Board, has announced.

The proposed expansion, which has been under study for almost a year, will include major additions at the company's Kings Mountain, N. C., and Sunbright, Va., plants. Facilities at the Exton, Pa., plant will be increased to a lesser extent. Many of the present facilities were designed and built in the expectation of further expansion.

Mr. Meyer stated that the probable cost of the proposed expansion will amount to several million dollars. The company expects to finance the cost of the new facilities through bank loans and does not contemplate any public financing at this time.

DIAMOND ALKALI ELECTS OFFICERS

The Board of Directors of Diamond Alkali Company has elected Raymond F. Evans as Chairman of the Board and John A. Sargent as President of the company. Advancement of the company's two top executives from the positions of President and Executive Vice President, respectively, emerged as the highlight of the organization meeting of the Board of Directors which followed the company's recent annual meeting. All 10 present directors were re-elected, and all other officers were renamed to present posts.

Mr. Evans, a veteran executive of Diamond Alkali, for many years has been a dynamic force behind the company's growth. He has been president since 1947 and previously was executive vice president, the position from which he planned and led Diamond's move into national prominence. His career with the company dates back to 1931 when, after majoring in chemistry at Princeton University, he joined the Painesville, Ohio, plant as a production worker.

Mr. Sargent has risen to the presidency of Diamond Alkali in less than eight years since joining the company as treasurer in 1946. He later became vice president-finance and in 1948 was elected executive vice president. A graduate of Sheffield Scientific School of Yale University, Mr. Sargent was formerly associated with the Campbell Metal Window Corporation and with Truscon Steel Company.

ARMSTRONG ORGANIZATIONAL CHANGES

Transfer of three men and assignment of three other employees has been announced by the Glass and Closure Division of the Armstrong Cork Company.

Russell E. Thompson, Jr., of the Charlotte sub-office of the company's Atlanta District Office, was transferred to the Milwaukee sub-office of the Chicago District Office. Edgar A. Roll, formerly with the Pittsburgh office, has transferred to Charlotte. It was also announced that Richard F. Broughton of the Chicago District Office was transferred to San Francisco.

Three additions to the Lancaster home office include John C. Pender, assigned to the Glass Container Sales Service Section; Joseph H. Copeland, assigned to the Cork Department Sales Service Section; and Eugene A. Valleroy to the Cap Department Sales Service Section. Mr. Valleroy replaces James F. Dussinger of the Lancaster Sales Service Department who has enrolled in an accelerated sales training course to be assigned to the field sales force on May 1.

A.S.T.M. TO PUBLISH LABORATORY DIRECTORY

The Directory of Commercial and College Laboratories, formerly compiled and published by the National Bureau of Standards of the U. S. Department of Commerce, will be published in the future by the American Society for Testing Materials, according to a recent agreement between the two organizations.

First published in 1927, the Directory has been periodically revised. It provides interested persons with information concerning the location of testing laboratories, together with the types of commodities and the nature of the investigations the laboratories are prepared to undertake.

Inventions and Inventors

Feeding and Forming

Apparatus for Forming Television Tube Blanks. Fig. 1. Patent No. 2,662,346. Filed August 1, 1949. Issued December 15, 1953. Four sheets of drawings. Assigned to Corning Glass Works by James W. Giffen.

Apparatus is shown in Fig. 1 for fabricating television tubes as an integral unit in a single operation with the aid of centrifugal action. A timer or clock T initiates the operation of a feeder under whose control a charge of molten glass is deposited in the cavity of a hollow open-ended mold 101 corresponding in form to that of the desired tubulated article. Upon rotation of the mold, which is preferably arranged vertically, the charge is distributed evenly and uniformly over the wall surfaces of the mold by centrifugal force set up in the molten glass itself.

A differential pressure, desirably obtained by the creation of a negative pressure in the tubular portion of the mold, is advantageously utilized to introduce the glass, and a retractable value member 105, similar in form to a conventional knockout valve, is provided to control the volume of glass introduced into the tubular portion. Such glass is subsequently laterally squeezed or extruded from between the valve and a second tool 117, referred to as a "distributor" and adapted to be controllably introduced into the tubular portion. Both the valve and the distributor are moved within such tubular portion to effect lengthwise distribution of glass in tubular form along the surface with the aid of the centrifugal force generated by the rotation of the mold. After the article has been formed, a trimmer assembly moves a grooving disc 130 into the cavity of the mold 101 to suitably groove the article along a desired line of severance for subsequent severance of the excess glass by thermal shear. The article is then automatically elevated by valve 105 for convenient and ready removal from the mold.

The patent contains 40 claims and 16 references were given.

Glass Forming Mold. Fig. 2. Patent No. 2,662,347. Filed May 5, 1951. Issued December 15, 1953. One sheet of drawings. Assigned to Corning Glass Works by James W. Giffen.

The present invention relates to the manufacture of hollow glass bodies, and is particularly concerned with the provision of molds suitable for use in the centrifugal formation of conically shaped hollow glass articles having base ends of noncircular outline. The transverse outline or cross-section of such a "rectangular" mold cavity, as shown in Fig. 2, is essentially a circle at its apex, is in general a modified ellipse in the levels from lines m—i with its major axis transverse to the 18⅜-inch dimension of the open end of the mold, and in the levels from lines h—a is also in general a modified ellipse, but with its major axis parallel to such 18⅜-inch dimension. In the median level of line i, the cavity outline is in general approximately circular and concentric to the circular outline z.

The wall contour is advantageously made to act as a barrier to the rotary component of movement imparted to the molten glass during its distribution. Accordingly, at least some of the levels represented by lines g—m, the axes of the ellipses represented by these lines, are desirably located forward through an arc varying from 2 to 5°. Similarly for a mold for the production of 24-inch (diagonal) funnels, the axes for such ellipses are desirably moved forward through arcs of from in the neigh-

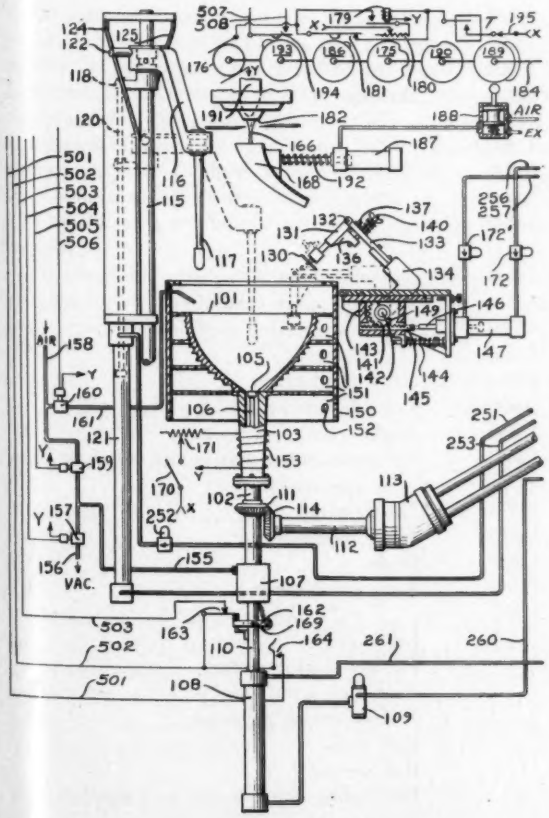


Fig. 1.

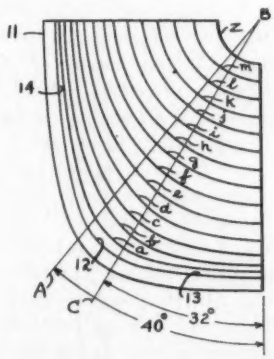


Fig. 2.

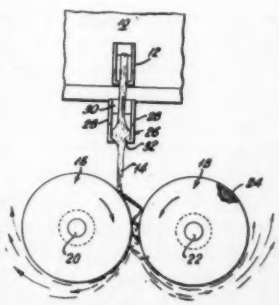


Fig. 3.

borhood of 4 to 8°. On attaining its optimum operating temperature, such a mold will regulate the distribution of molten glass over its cavity wall in a fashion to produce funnels which are far superior to any corresponding funnels made by prior methods and which have all the virtues of a centrifugally formed circular funnel.

The patent contains 18 claims and the references cited were as follows: 328,482, Haley, Oct. 20, 1885; 2,224,488, Rendall, Dec. 10, 1940; 2,478,624, De Vine, Aug. 9, 1949; and 223,812, Switzerland, Oct. 15, 1942.

Glass Compositions

Staining of Glass. Patent No. 2,662,035. Filed May 13, 1953. Issued December 8, 1953. No sheets of drawings. Assigned to Verd-A-Ray Processing Company by Ormonde S. Levi.

This invention relates to compositions and methods for staining soda-lime, borosilicate, lead glasses and the like, and to the articles produced. An object is to provide compositions and methods for staining glass in a variety of colors, and thus produce new and improved stained glass articles.

The predominant factor in controlling the color of the stain is the percentage of the three metal ions, Ag, Zn and Cu. To illustrate the effect of these metal ions on the color, the following results are shown in the table below.

Soda-lime glass was used having an analysis of 73.50% SiO_2, 1% R_2O_3, 16.5% Na_2O, 0.15% K_2O, 0.89% B_2O_3, 4.82% CaO and 3.33% MgO.

The patent contains 32 claims and no references were cited.

Formula Number	Per cent Ag	Per cent Zn	Per cent Cu	Baking temperature °F.	Color
1	0	42.0	58.0	1,000	Very light straw
2	.875	41.6	57.525	1,000	Light green
3	1.7	41.3	57.0	1,000	Bright yellow green
4	3.4	40.6	56.0	1,000	Good medium green
5	5.04	39.85	55.01	1,000	Very good green
6	6.61	39.25	54.14	1,000	Slightly darker green
7	8.12	38.63	53.25	1,000	Mixed red and green
8	9.59	37.95	52.46	1,000	"
9	10.92	37.43	51.65	1,000	Red increasing
10	12.38	36.81	50.81	1,000	Red becoming deeper
11	13.8	36.2	50.0	1,000	Red deepening
12	14.96	35.75	49.29	1,000	"
13	16.3	35.2	48.5	1,000	"
14	17.52	34.65	47.83	1,000	"
15	21.0	32.2	45.8	1,000	Amber
16	26.1	31.1	42.8	1,000	"
17	30.6	29.2	40.2	1,000	"
18	34.3	27.7	38.0	1,000	"
19	8.43	0	91.57	1,000	"
20	8.20	1.80	90.0	1,000	"
21	8.1	3.5	88.4	1,000	"
22	7.8	6.9	85.3	1,000	Trace of green
23	7.55	9.95	82.5	1,000	Red and green mixed
24	6.85	18.15	75.0	1,000	Red disappearing green better
25	5.80	30.7	63.5	1,000	"
26	5.01	40.0	55.0	1,000	Very good green
27	4.4	47.0	48.6	1,000	Color becoming muddy
28	2.5	69.0	28.5	1,000	Slight trace of green left
29	2.2	74.6	23.2	1,000	No green but a stain exists which is milky in appearance
30	11.0	89.0	0	1,000	No staining
31	7.60	60.4	32.0	1,000	Light medium red
32	5.76	45.82	48.42	1,000	Green
33	4.64	36.78	58.58	1,000	Very good green
34	3.89	30.9	65.2	1,000	"
35	21.5	0	78.5	—	Light amber
36	20.2	5.95	73.85	—	Slightly darker amber
37	17.95	15.95	66.1	—	Assuming a red tone
38	16.4	24.2	49.4	—	Red becoming stronger
39	14.93	30.64	54.4	—	Fair red
40	13.65	36.2	50.3	—	Red deeper
41	11.0	48.6	40.4	—	Red fading out
42	9.5	55.95	34.64	—	Same as 41

Staining of Glass. Patent No. 2,662,036. Filed May 13, 1953. Issued December 8, 1953. No sheets of drawings. Assigned to Verd-A-Ray Processing Company by Ormonde S. Levi.

This invention relates to compositions of staining glass similar to Patent No. 2,662,035. More particularly the invention is directed to forming a finely divided, uniform oil dispersion containing copper, silver and zinc compounds and an inorganic chloride compound in amounts sufficient to stain glass. This type of stain lends itself very nicely for such applications as brushing, spraying, screening or dipping.

The patent contains 15 claims and no references were cited.

Staining of Glass. Patent No. 2,662,037. Filed May 13, 1953. Issued December 8, 1953. No sheets of drawings. Assigned to Verd-A-Ray Processing Company by Ormonde S. Levi.

This invention relates to compositions of staining glass similar to Patent No. 2,662,035. It has been discovered that the combination of copper, silver and zinc salts in the presence of certain organic chloride compounds, like trichloroacetic acid, benzyl chloride, or the like, in uniform oil dispersion produces an active material for staining glass. The resulting oil is especially suitable for dipping.

The patent contains 12 claims and no references were cited.

Glass Composition for Fibers. Patent No. 2,664,359. Filed June 1, 1951. Issued December 29, 1953. No drawings. Assigned to Owens-Corning Fiberglas Corporation by David P. Dingledy.

The present invention relates to a glass composition which, because of its properties and particularly its high fluidity, is advantageously adapted for glass fibers. A high fluidity without loss of other necessary properties is very desirable in a glass since more production is realized at a standard operating temperature; or the standard production may be obtained at a lower operating temperature with a resulting less severe attack on refractories and the like; or gradations between these extremes may be used.

The desirable range of compositions and the preferred composition of the present invention in weight per cent are:

	Desirable range Per cent	Preferred Composition Per cent
SiO_2	55-60	55.4
Al_2O_3	4- 6	4.5
CaO	15-19	18.4
MgO	4- 6	6.7
Na_2O	10-13	10.1
B_2O_3	2- 4	3.0
TiO_2	1- 4	1.9

The patent contains 13 claims and the following references were cited: Re. 23,049, Armistead, Nov. 23, 1948; 2,055,446, Powell, Sept. 22, 1936; 2,468,654, Brundell et al., Apr. 26, 1949; 2,523,264, Armistead, Sept. 26, 1950; 2,523,265, Armistead, Sept. 26, 1950; and 2,527,693, Armistead, Oct. 31, 1950.

Glass Wool and Fiber

Method and Apparatus for Fiberizing Mineral Materials. Fig. 3. Patent No. 2,663,051. Filed January 24, 1951. Issued December 22, 1953. One sheet of drawings. Assigned to Johns-Manville Corporation by Bruce A. Graybeal.

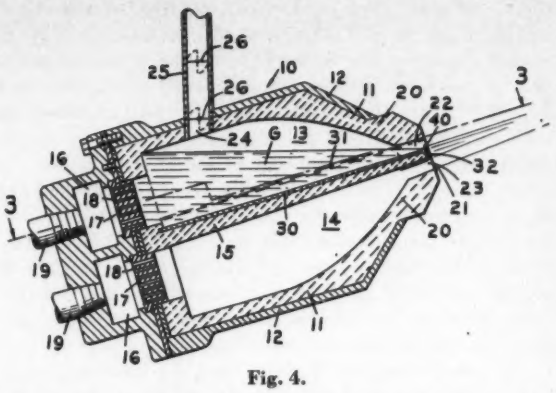


Fig. 4.

This invention relates to an improved mineral wool fiberizing method and apparatus. Such materials are fiberized by a spinning process in which a stream of the molten material is discharged onto one or a plurality of cooperating spinners or rotors rotated at high speed, the centrifugal forces set up causing portions of the material on the rotors to be drawn out into fibers.

The fiberizing rotors are 16 and 18, and are supported on shafts 20 and 22, as shown in Fig. 3. The rotors are of heat-resistant steel or other alloy of a character to chill and bond a portion of the material and thus resist the high temperature of the molten material, which may run as high as 2900°F. without excessive erosion or wear. A stream distributor, indicated at 26, is supported in the path of the stream 14. The distributor comprising a trough 28 is given a relatively rapid reciprocating, oscillating or vibratory motion.

In the operation of the apparatus, the fiberizing device is positioned relatively to the delivery end of trough 28, when the latter is in its intermediate position, so that molten material falling from the trough by gravity would strike rotor 16 substantially centrally of the width, and on a downturning segment, of its peripheral surface.

The patent contains 5 claims and the following references were cited: 180,470, Elbers, Aug. 1, 1876; 1,679,385, Stay et al., Aug. 7, 1928; 2,398,707, Hawthorne et al., Apr. 16, 1946; 2,456,439, Morane et al., Dec. 14, 1948; and 2,518,744, Barnard, Aug. 15, 1950.

Method for Producing Glass Fibers. Fig. 4. Patent No. 2,663,903. Filed November 2, 1948. Issued December 29, 1953. Two sheets of drawings. Assigned to Owens-Corning Fiberglas Corporation by Charles J. Stalego.

A burner assembly is shown wherein the combustion chamber serves as a container for molten glass and the glass is drawn out from the outlet opening by the force of the products of combustion escaping through the outlet opening.

The level of molten glass G in the chamber 13 is maintained so that a quantity of molten glass extends into the discharge port 22 in the manner diagrammatically indicated in Figure 4. This molten glass is subjected to the force of the products of combustion escaping through the port 22, and the velocity of the gaseous products of combustion is sufficiently high to provide the force required to blow molten glass into the atmosphere from

the tip or front edge of the liner 30. The stream of gas issuing from the discharge port 22 is assisted in blowing molten glass into the atmosphere by the stream of products of combustion discharging through the bottom port 23. The stream of gas issuing from the port 23 combines with the stream of gas issuing from the port 22 immediately adjacent the front edge of the liner 30. Thus, in effect, the molten glass at the tip or front edge of the liner 30 is engaged between the two high velocity blasts and is blown with considerable force into the atmosphere. Any tendency for molten glass to "pile up" or accumulate at the flanges 35 of the liner is prevented by the high velocity blast flowing into the atmosphere through the passages 36 (not shown) located at the sides of port 22.

The patent contains 15 claims and the following references were given: 1,328,446, Odam, Jan. 20, 1920; 2,178,871, Drill, Nov. 7, 1939; 2,233,304, Bleakley, Feb. 25, 1941; 2,405,036, Hoffman, July 30, 1946; 2,455,907, Slayter, Dec. 7, 1948; and 2,554,486, Austin, May 29, 1951.

Method of Producing Fine Glass Fibers. Fig. 5. Patent No. 2,663,906. Filed June 19, 1951. Issued December 29, 1953. One sheet of drawings. Assigned to Glass Fibers, Inc. by Dominick Labino.

An object of this invention is to provide a method for producing extremely fine glass fibers of the order of ten to twenty millionths of an inch in diameter. In the apparatus shown in Fig. 5 there is provided a heating crucible 10 having a heating coil 11. Glass is fed into the crucible 10 through a feed tube 12, the gas being in the form of marbles 13 under control of alternately operating solenoid operated slide valve mechanisms 14 and 15. Molten glass exudes through a plurality of openings 17 provided in the bottom wall of the crucible 10. The streams of molten glass are engaged by rollers 18 and 19 whereby the glass streams between the rollers 18, 19 and the crucible 10 are drawn and attenuated into fine glass strands preferably on the order of three to four thousandths of an inch.

The fine glass strands 25 are fed over a guide block 26 so that the ends of the fine strands 25 will be directed into the path of a high velocity stream of high temperature gas issuing from the burner 30. The burner 30 has a combustion chamber 31. The high temperature high velocity gases 35 striking the ends of the glass strands 25 will cause them to melt rapidly and be blown in the direction of flow of the glass stream into fine fibers or filaments. The fine glass fibers 36 are blown onto a fine wire mesh belt 40 that is carried between rolls 41 and 42 driven by an electric motor 43. The glass fibers are collected on the surface of the belt 40. The glass fibers collecting on the belt 40 forms a mat 45 that is separated from the belt by a blade 46 and is carried to a roll 47.

The patent contains 2 claims and the references cited were: 2,450,363, Slayter et al., Sept. 28, 1948; 2,460,993, LeBrasse et al., Feb. 8, 1949; 2,489,242, Slayter, Nov. 22, 1949; 2,489,243, Stalego, Nov. 22, 1949; 2,489,244, Stalego, Nov. 22, 1949; and Steam, Its Generation and Use, published by the Babcock & Wilcox Co., New York, 35th Edition, 1913, page 231.

Apparatus for Fabricating Reinforced Glass Fiber Strands. Patent No. 2,664,138. Filed September 14, 1951. Issued December 29, 1953. Three sheets of drawings (none reproduced). Assigned to Owens-Corning Fiberglas Corporation by Games Slayter and Ed Fletcher.

This invention relates to apparatus for the fabrication of continuous strands, cords, rods or tubes according to the process disclosed in concurrently filed copending application Serial No. 246,686, and No. 246,685. Such articles are continuously fabricated from a narrow strip of sheet material moved longitudinally and, simultaneously with such longitudinal movement, progressively rolled laterally by turning one of its edges inwardly upon the strip and laterally rolling the strip to form a helix in cross section.

By commencing the rolling of the article along one edge only and by maintaining the article in relatively taut condition during rolling, the edge of the article opposite that which is turned over to start the rolling, remains straight. This construction is particularly advantageous where longitudinally extending reinforcing media are embodied in the finished article or strand-like object, such as an electrical conductor, a strong wire or other similar objects.

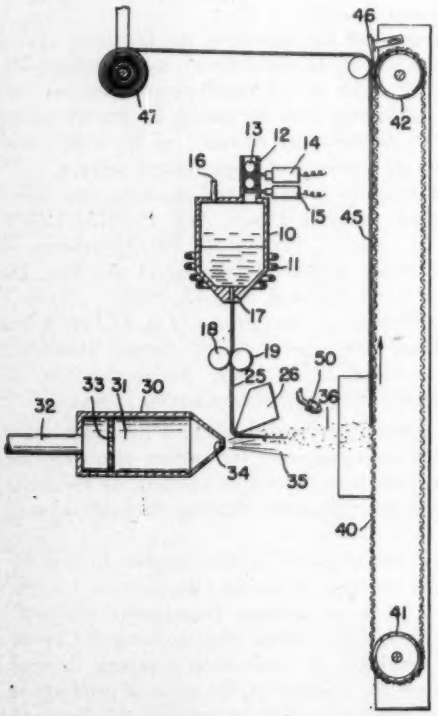


Fig. 5.

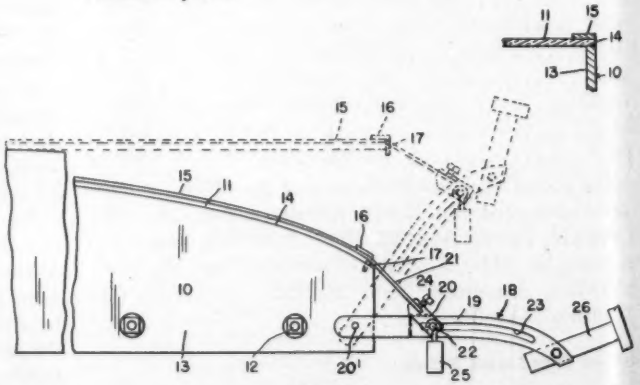


Fig. 6.

The patent contains 11 claims and the following references were cited: 1,674,171, Gammeter et al., June 19, 1928; 1,695,622, Wachsmuth, Dec. 18, 1928; 1,708,129, Gammeter, Apr. 9, 1929; 1,726,755, Morris, Sept. 3, 1929; 2,074,580, Fourness et al., Mar. 23, 1937; 2,135,880, Waldman et al., Nov. 8, 1938; 2,553,757, Evans, May 22, 1951; and 2,577,843, Crosby et al., Dec. 11, 1951.

Method for Printing Pigment Colors on Glass Fabrics. Patent No. 2,664,365. Filed May 19, 1950. Issued December 29, 1953. No drawings. Assigned to Stein, Hall & Company, Inc. by Fred G. La Piana and George N. Houth.

The present invention relates to an improved printing paste suitable for use in printing pigment colors on glass fibers. The method consists of printing on a glass fabric a printing paste containing the desired pigment and consisting essentially of from 15 to 50% by weight of pigment binder, and 85% to 50% by weight of a dilute solution of a water-soluble alginate. If desired, the printing paste may contain a small proportion, i.e. of the order of 1 to 5% by weight of a penetrant such as "Ergitol #7". The pigment binder consists of a mixture of vinyl chloride latex, synthetic rubber latex, water soluble protein, formaldehyde and a light mineral oil.

After application of the printing paste to the material by conventional methods, the printed material is thoroughly dried, e.g. for two to three minutes at temperatures up to about 300°F., and then passed through a bath of water-insolubilizing agent to form a water-insoluble alginate, the time of immersion in the bath being of the order of 10 to 20 seconds. Following the after-treatment, the material is dried. If desired, the dried material may be subjected to a soap scouring and again frame-dried.

The patent contains 4 claims and the references cited were: 2,275,991, Powers et al., Mar. 10, 1942; 2,290,633, Cate, July 21, 1942; 2,364,738, Marberg et al., Dec. 12, 1944; 2,450,902, Marberg, Oct. 12, 1948; and 2,511,113, La Piana, June 13, 1950.

Sheet and Plate Glass

Apparatus for Bending Glass Sheets. Fig. 6. Patent No. 2,663,974. Filed July 23, 1951. Issued December 29, 1953. Two sheets of drawings. Assigned to Motor Products Corporation by Robert W. Thomson.

An improved apparatus is provided to bend glass sheets of substantial size to a curved contour on a large volume production basis without marking, distorting or affecting the true optical characteristics of the glass.

Referring to Fig. 6, the form 10 has laterally spaced vertical side members or walls 13 connected together by the rods 12. The top edges of the side members 13 are convexedly curved in the direction of length of the members and provide relatively narrow supporting surfaces or seats 14 having a length at least as great as the length of the sheet 11 or glass to be bent. Lateral spacing of the side members 13 is so determined with respect to the width of the sheet 11 to be bent that the seats 14 respectively engage the underside of the sheet adjacent opposite side edges thereof.

The bending form 10 has means indicated generally by the numeral 18 which act on opposite ends of the flexible strips 15 to bend the strips to the curvature of the seats 14 on the form and in practice cause the strips

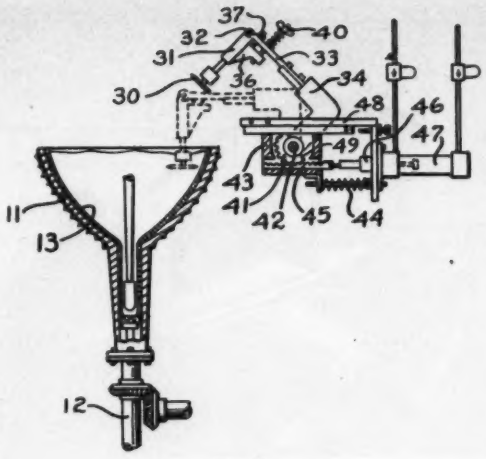


Fig. 7.

15 to apply a downward pressure on the top surface of the sheet 11 directly opposite the seats 14. This downward pressure is applied continuously along the length of opposite side edges of the sheet 11 and assists materially in bending the sheet 11 to the curvature of the seats 14. Under such conditions it is possible to more readily bend the sheet 11 to the contour of the form at temperatures somewhat lower than heretofore employed where gravity alone is relied upon to accomplish the bending operation.

The patent contains 13 claims and the following references were cited: 1,889,881, Thompson, Dec. 6, 1932; 1,999,558, Black, Apr. 30, 1935; 2,223,123, Owen, Nov. 26, 1940; 2,330,349, Galey, Sept. 28, 1943; 2,348,887, Drake, May 16, 1944; 2,370,827, Weichbrodt et al., Mar. 6, 1945; and 2,377,849, Binkert et al., June 12, 1945.

Tube and Cane Machines

Glass Severing Apparatus. Fig. 7. Patent No. 2,662,289. Filed November 29, 1951. Issued December 15, 1953. One sheet of drawings. Assigned to Corning Glass Works by James W. Giffen.

The removal of excess glass from a television tube, following its formation and prior to the removal from the mold, is very important.

The numeral 11 in Fig. 7 designates a vertically arranged tubulated mold adapted for rotation about the axis of its tubulation by a shaft 12 to centrifugally form molten glass deposited within the mold cavity into a hollow glass article 13. Such a centrifugally formed article generally lacks uniformity in height and its top edge is trimmed while the mold is still rotating.

This trimming is accomplished by means of a disc 30 which is brought into the mold 11 and into engagement with the wall of the glass article 13, while the mold is still rotating. This operation is done immediately following the formation of the article and while the glass is still workable to form a groove of sufficient depth to readily effect subsequent severance by thermal shear along the desired line of fracture. Disc 30 is rotatably carried at the bottom end of a support 31 pivoted at 32 on the outer end of a support 33 extending from one end of elbows 34. The disc support 31 is provided with a bracket 36 adapted to engage a stop 37 adjustable to set disc 30 at a position such that its edge will be substantially normal

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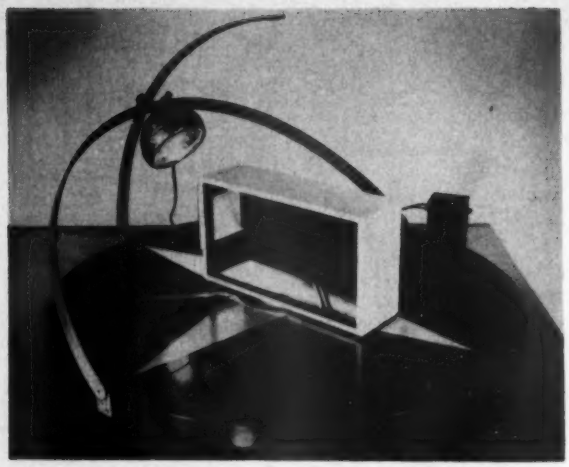

This Solarometer accurately illustrates the diffusing properties of any rolled glass pattern in a specific geographical location at any given time of the day.

MISSISSIPPI GLASS DAYLIGHTING DEMONSTRATIONS

Explaining the daylighting qualities of rolled glass through the medium of audience participating demonstrations, as well as augmenting the efforts of the company's field representatives, is the task of a two-member Architectural Promotion Team whose assignment began two years ago.

Since the inception of this department by Mississippi Glass Company, the carefully trained two-man team has been engaged in interpreting the technical aspects of rolled, figured and wired glass to architectural and engineering groups in this country and in Canada. Visual aids, such as color slides, laboratory equipment and specially constructed model buildings and daylighting devices, are employed to demonstrate the properties of various Mississippi Glass patterns.

To date, in excess of 2200 key people in over 27 metropolitan cities, instrumental in the selection and specification of Mississippi products, have witnessed the demonstrations. The team has traveled in excess of 35,000 miles.

H. H. BAKER RETIRES FROM L-O-F

Herbert H. Baker, active in the glass industry of Toledo since 1910 and associated with the late Edward Drummond Libbey in three of his Toledo companies, retired as Vice President and Secretary of Libbey-Owens-Ford Glass Company. Mr. Baker will continue as a Director of the company, a post to which he was first elected in 1937.

Mr. Baker joined the former Libbey Glass Company in 1910, following his graduation from Yale University with a Bachelor of Arts degree, and was later put in charge of the railway signal glassware department. In 1916, he transferred to the Owens Bottle Machine Company (now Owens-Illinois Glass Company) to become assistant to John D. Biggers, now L-O-F Chairman, who then was Treasurer of the Owens company. Mr. Baker, himself, was Treasurer of Owens when he left it in 1926 to become assistant to the late James C. Blair, President of the then Libbey-Owens Sheet Glass Company. Mr. Baker was elected Vice President and Secretary in 1927.

WESTINGHOUSE DEVELOPS NEW TV COLOR TUBE

A new color television picture tube that produces a 20-inch (diagonal) color picture, comparable in contour and size to the standard 21-inch black-and-white tube, is under development by the Westinghouse Electronic Tube Division.

A significant advancement in the new tube is its larger screen size coupled with the use of a phosphor screen which has 20 complete color groups per inch compared to 17 previously used. This gives improved resolution and excellent color definition at normal viewing distances. The total viewing area of the screen is approximately 200 square inches. The over-all size of the tube has been held to a minimum by using a 24-inch (diagonal) metal cone and 70-degree deflection.

The screen of the tube consists of lines of three color phosphors which produce the colors red, green and blue. The lines, 80 to the inch, are alternately deposited on a flat glass plate by either silk-screen printing or a photographic process. The complete color-pack assembly includes the beam-diffusing wire grid, mounted parallel to the phosphor lines so that the grid is between the screen and the gun.

A 3.58-mc sine wave signal applied to the grid deflects the beam alternately over the three color phosphors. Color information is applied sequentially to the single gun in synchronism with the 3.58-mc switching signal so that at the instant the beam is focused over one of the phosphors, it is carrying the appropriate color information.

UNIVERSITY STUDENTS EMBARK ON GLASS PROJECT

Two hundred University of Pennsylvania students have begun an eight-week project aimed at streamlining the plant layout of one of the largest producers of glass television tube enclosures. Industrial management students in the University's Wharton School of Finance and Commerce undertook the project at the request of the Pressware Plant of the Corning Glass Works.

Forrest E. Behm, Jr., Manager of the Pressware Plant, presented the problem to the students. The students will work in teams, each team seeking its own solution. Corning, Mr. Behm said, hopes to adopt any student proposals that would make the plant layout more efficient, saving production time and costs.

PENNSALT CREATES NEW OPERATING DIVISIONS

To provide more logical product grouping, better customer service and a suitable pattern of organization for expected future growth, the Pennsylvania Salt Manufacturing Company will establish two new operating divisions, President George B. Beitzel has announced.

These new components—the Industrial Chemicals and Chemical Specialties Divisions—will function as complete operating units responsible for both the manufacture and sale of their respective products.

• The Cleveland office of Leeds & Northrup Company has been moved to 1922 East 107th Street from its former location in the B. F. Keith Building, 1621 Euclid Avenue. D. E. Moat is Manager of the Cleveland Office.

The Thermal Shock Resistance of Sheet Glass

Much has been published on the subject of thermal shock resistance of glass containers and during the last two decades, precise testing methods have been developed for appraising the commercial suitability of such containers by tests of thermal shock resistance of the material. On the other hand, while the thermal shock resistance of sheets of glass has received a good deal of study, very little has been published on this phase of the subject. Recently K. Dinger (*Verre et Silicates Industriels*, October 1948) reported on the results of thermal shock tests on pieces of sheet glass. Since some 5,000 pieces of glass were tested by Dinger, the results should have considerable significance from a statistical point of view. Because of the scarcity of such data in the literature, W. C. Levengood and E. C. Montgomery (*Journal of the Society of Glass Technology*, December 1953) have studied the data obtained by Dinger and report additional interpretations.

In Dinger's work the samples tested were glass plates 10cm. square and of various thicknesses. The squares of glass were heated to the desired temperature t_1 in an oven, and were then plunged into a water bath held at a temperature t_2 of 20°. The difference in temperature t_1-t_2, expressed in degrees Centigrade, is the dependent variable in the studies. In general, at least 100 pieces of glass of a given thickness were tested. If a piece was not broken in the test, it was not used a second time. The experiments generally were carried out by increasing the temperature differences by 10° increments from a point where none broke to a point where 100 per cent were broken. The data obtained is given in Table I.

In interpreting the data, Dinger seems to have overlooked the possibility that the thermal shock resistance, measured by the difference of temperature that could be withstood, might bear a fairly strict mathematical relationship to the thickness such as has been found for beakers and glass rods. The data, therefore, were examined from this point of view, and it was found, as was expected, that the thermal shock resistance of the 10cm. square panes of glass did indeed vary inversely as the square root of the thickness. In illustration of this, take the data for 50 per cent breakage. These are as follows:

Observed Temperature Thickness in mm.

50% Breakage (Δt)	($\sqrt{d}$)	$\Delta t \times \sqrt{d}$
138°	2.0	195
116	2.8	195
98	3.8	191
85	5.0	190
79	6.0	194

The substantial agreement of the figures in the last column is an indication of the degree to which the square-root rule holds over a range of thicknesses from about 2.0 to 2 mm.

Another important aspect in the study of this data is the possibility that for any given thickness the frequency of breakage might follow a Guassian distribution curve. A plot of the data using probability paper showed that the curves are approximately a straight line, and indicate that the distribution is normal. The coefficient of variation was about 11.8 per cent.

TABLE I

Resistance of Glass to Temperature Variations
(Dimensions of Square Pieces: 10 x 10 Cm.)

Temperature Difference	Samples	E.D.	6/4	8/4	5mm.	6mm.
60°	Thickness	—	—	3.94	5.09	6.02
	% Broken	—	—	0	0	0
70°	Thickness	—	—	3.93	5.08	5.99
	% Broken	—	—	2	7	19
80°	Thickness	—	2.94	3.93	4.99	6.05
	% Broken	—	6	17	25	59
90°	Thickness	—	2.88	3.88	5.12	5.86
	% Broken	—	6	26	68	93
100°	Thickness	1.80	2.86	4.00	4.96	5.97
	% Broken	1	24	53	76	100
110°	Thickness	1.88	2.90	3.76	5.11	—
	% Broken	3	34	80	100	—
120°	Thickness	1.80	2.86	—	—	—
	% Broken	10	59	100	—	—
130°	Thickness	1.86	2.85	—	—	—
	% Broken	36	77	—	—	—
140°	Thickness	1.78	2.83	—	—	—
	% Broken	47	99	—	—	—
150°	Thickness	1.96	—	—	—	—
	% Broken	81	100	—	—	—
160°	Thickness	1.81	—	—	—	—
	% Broken	91	—	—	—	—
170°	Thickness	1.84	—	—	—	—
	% Broken	95	—	—	—	—
180°	Thickness	1.81	—	—	—	—
	% Broken	100	—	—	—	—

Values for various percentages broken were plotted against $\frac{1}{\Delta t \sqrt{d}}$, and the points generally lie on a straight line, the equation of which, between 20 and 90 per cent broken, is substantially

$$\Delta t \sqrt{d} = \frac{1}{(-0.000019)\ P + 0.0062} \quad . \quad (1)$$

where Δt is the temperature difference that caused breakage, d the thickness and P is the percentage broken. From equation (1) it is possible to predict the per cent breakage that might be expected for any temperature difference with an accuracy of the order of plus or minus five or six per cent.

One important factor in connection with thermal shock testing of glass sheets is the condition of the edges. For example, the presence of a cut edge or a seamed edge, the age of the sample before testing and the size of the grit used in the seaming may all influence the thermal shock resistance of the glass. Inasmuch as these variables have not been well defined, it seemed worthwhile to make experimental investigations to determine the effect of these edge conditions.

A group of "as-cut" samples tested immediately after cutting (within 1 or 2 hours) were compared with a portion of this same group that were allowed to age six

(*Continued on page* 280)

L-O-F APPOINTMENTS

Rapid growth of the Thermopane plant of Libbey-Owens-Ford Glass Company has brought about changes in its management organization which have been announced by Curtis W. Davis, Vice President in charge of Production, and Russell H. Bruot, the new Plant Manager.

Charles Shelly, who has been active in the development of the insulating glass product since he joined the firm in 1935, has been named General Manufacturing Superintendent of the plant. Formerly, he has been in charge of plant operations. George P. MacNichol, III, who was in charge of production scheduling at Thermopane prior to becoming operating supervisor at Electrapane at East Toledo, has returned to the Thermopane plant in Rossford as Production Manager.

Also announced is the promotion of Eugene Babcock to operating supervisor to succeed Mr. MacNichol. Mr. Babcock has been associated with Libbey-Owens-Ford as a member of the Rossford technical control department on special assignment in the development of Glass Seal Thermopane.

Horace G. Orser, for nine years in charge of Thermopane production, has been promoted to Manager of special glass products manufacture. In his new position, Mr. Orser will have over-all company responsibilities covering the manufacture of products for the national defense.

• Carl G. Ruppel, Comptroller of Canadian Pittsburgh Industries Limited, Toronto, has been elected to membership in the Controllers Institute of America.

P. M. OFFILL JOINS REINTJES COMPANY

George P. Reintjes has announced the appointment of Paul M. Offill, Sr. as General Sales Consultant for the Geo. P. Reintjes Company, manufacturers of suspended arches and walls for the steel, glass and various other industries.

Mr. Offill retired recently after more than 28 years of active service as Vice President in charge of Sales for the Amsler Morton Corporation and is now enjoying an interval of rest and recreation in the Bahamas.

BABCOCK & WILCOX ELECTS BOARD MEMBER

Edward A. Livingstone, Vice President of The Babcock & Wilcox Company, was elected to the Board of the Directors of the company at the recent annual stockholder's meeting.

At the organization meeting of the Board later, Mr. Livingstone was placed in charge of the company's Tubular Products Division. He takes over the position vacated by Luke E. Sawyer, who became a consultant to the company.

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Current Statistical Position of Glass

Employment and payrolls: Employment in the glass industry during February 1954 was as follows: *Flat Glass:* A preliminary 30,000 was reported for February. This is a 3.5 per cent drop from the adjusted 31,000 persons employed during January. *Glass and Glassware, Pressed and Blown:* An increase of .7 per cent is indicated by the preliminary 82,800 employment reported as compared with the previous month's adjusted 82,200. *Glass Products Made of Purchased Glass:* A preliminary 12,900 employment was reported indicating a drop of 1.5 per cent from the January adjusted employment of 13,100.

Payrolls during February 1954 were: *Flat Glass:* A preliminary $13,015,600 was reported during February. Compared with January adjusted payrolls of $13,383,678, a drop of 2.7 per cent is shown. *Glass and Glassware, Pressed and Blown:* Preliminary payrolls for February were reported to be $25,087,296. An increase of 2.6 per cent is shown when compared with the previous month's adjusted $24,449,568. *Glass Products Made of Purchased Glass:* A preliminary $3,412,695 was reported for February. Compared with January's adjusted $3,312,335, an increase of 3 per cent is shown.

Glass container production, based on figures released by the Bureau of Census, jumped to 11,200,000 gross during March 1954. Compared with February production of 9,556,590 gross, March production was 17.1 per cent higher. During March 1953, production was 10,696,973 gross, or 4.7 per cent lower than for this year. At the end of the first quarter of 1954, a total of 30,765,616 gross of glass containers have been produced. Compared with the 28,989,851 gross produced during the corresponding period of 1953, production this year is running 6.1 per cent ahead of last year.

Shipments of glass containers also jumped to reach a new second high of 12,134,000 gross. However, as was the case for March 1953 when the all-time high of 12,292,685 gross was established, it is believed that these unusually high shipments were brought about by the forthcoming price rise for glass containers. Compared with February shipments of 8,423,520 gross, March is 44 per cent higher and 1.2 per cent lower than March 1953. During the first quarter of 1954, glass container manu-

(*Continued on page* 285)

GLASS CONTAINER SHIPMENTS

(All Figures in Gross)

Narrow Neck Containers	March, 1954
Foods	1,364,000
Medicinal & Health Supplies	1,611,000
Chemicals, Household & Industrial	905,000
Beverages, Returnable	535,000
Beverages, Non-returnable	65,000
Beer, Returnable	219,000
Beer, Non-returnable	697,000
Liquors	878,000
Wines	480,000
Toiletries & Cosmetics	684,000
Sub-total (Narrow)	7,438,000
Wide Mouth Containers	
Foods	* 3,392,000
Dairy Products	184,000
Medicinal & Health Supplies	504,000
Chemicals, Household & Industrial	191,000
Toiletries & Cosmetics	214,000
Sub-total (Wide)	4,485,000
Total Domestic	11,923,000
Export Shipments	211,000
TOTAL SHIPMENTS	12,134,000

* This figure includes Fruit Jars, Jelly Glasses and Packers' Tumblers.

GLASS CONTAINER PRODUCTION AND INVENTORY

(All Figures in Gross)

		Production March 1954	Stocks March 1954
Foods; Medicinal & Health Supplies; Chemicals, Household & Industrial; Toiletries and Cosmetics	Narrow Neck	4,024,000	3,635,000
	Wide Mouth	*4,089,000	*3,845,000
Dairy Products		193,000	313,000
Beverages, Returnable		739,000	1,443,000
Beverages, Non-returnable		84,000	180,000
Beer, Returnable		295,000	467,000
Beer, Non-returnable		682,000	916,000
Liquors		709,000	825,000
Wines		385,000	367,000
TOTAL		11,200,000	11,991,000

* This figure includes Fruit Jars, Jelly Glasses and Packers' Tumblers.

1953 TOTALS
GLASS CONTAINER SHIPMENTS AND PRODUCTION

(All Figures in Gross)

Narrow Neck Containers	Shipments	Production
Foods	12,542,704	
Medicinal & Health Supplies	13,168,780	
Chemicals, Household & Industrial	8,904,900	
Toiletries & Cosmetics	6,930,170	
General Use Total	41,546,554	42,793,276
Beverages, Returnable	8,787,497	9,407,977
Beverages, Non-returnable	1,056,433	1,080,499
Beer, Returnable	2,853,934	3,309,280
Beer, Non-returnable	8,330,980	8,592,706
Liquors	9,014,933	9,575,826
Wines	4,174,263	4,209,356
Sub-total (Narrow)	75,764,594	78,968,920
Wide Mouth Containers		
Foods	* 31,664,175	
Medicinal & Health Supplies	4,600,187	
Chemicals, Household & Industrial	1,898,439	
Toiletries & Cosmetics	2,007,352	
General Use Total	40,170,153	*41,298,253
Dairy Products	3,362,457	3,357,524
Packers' Tumblers	2,012,480	2,116,805
Sub-total (Wide)	45,545,090	46,772,582
Total Domestic	121,309,684	—
Export Shipments	3,089,613	—
TOTAL	124,399,297	125,741,502

* This figure includes Fruit Jars and Jelly Glasses.

BOOK REVIEWS

The Physical Chemistry of the Silicates

By Wilhelm Eitel

This book is an English version of the German publication by Professor Eitel, who is now associated with the University of Toledo. It has been revised and enlarged to include and assess all the latest technical advances and most recent theories. It is a comprehensive survey of all the facts and theories relating to silicates, and brings together everything that is at present known of their physical-chemical constitution and reactions.

The aggregate states of silicates, which are important for their investigation, are presented in detail: the crystalline structure, the glassy state and the colloidal systems. The fusion and polymorphism equilibria are thoroughly discussed, with special emphasis upon the heterogeneous equilibria in multicomponent anhydrous silicate systems. Also described at length are systems of silicates with volatiles, chiefly CO_2, fluorides and water. Careful consideration is given reactions in the solid state, the proper ceramic systems and the physical chemistry of hydraulic cements. Finally, a whole section is dedicated to physical-chemical phenomena observed in industrial glass, enamels and slags of highly complex constitution.

The Table of Contents includes: The States of the Silicates, Fusion and Polymorphic Equilibria in Dry Silicate Systems, Pneumatogenic and Hydatogenic Silicates, Solid-State Reactions and their Ceramic Use and Silicate Melts as Industrial Glasses and Slags.

Published by The University of Chicago Press, Chicago, Illinois; 1575 pages; $30.00.

Optical Workshop Principles

Second Edition

By Charles Deve; Translated by T. L. Tippell

This second edition of Optical Workshop Principles contains about fifty per cent of new material, as well as many revisions by its original author and his editor, M. Georges Gaudet.

The principles of the production of optical work of high quality are set forth and information on workshop methods and compositions is also presented. Useful data on abrasives and tools is given and there is information contained on means and methods of optical testing, working of crystalline materials for polarizing prisms, preparation of cross line and other graticules and metallization. There is a 40-page chapter on spectacle lenses and an Appendix of about 40 pages is devoted to suggestions for surfacing aspherical lenses.

Available in the United States through Jarrell-Ash Company, 26 Farwell Street, Newtonville 60, Mass.; 436 pages; $8.75.

Materials and Processes, Second Edition

By James F. Young

This second edition of Materials and Processes has been almost completely rewritten for the benefit of those concerned with product development, design, production, processing and quality. The emphasis throughout is on the engineering fundamentals of metallic and non-metallic materials, manufacturing processes, and their applications to the above activities.

To provide wider usefulness, the author has expanded the coverage of non-metallic materials, constructional materials, and many materials and processes used in product industries. Recent developments in physical metallurgy and chemistry have been added, as well as typical material property data and process tolerances.

Among the new chapters are those on metallographic examination, glass, structure and properties of non-metallic materials, ceramics, porcelain, statistical methods used in quality control and rubber. New sections also appear on blow and shell molds, non-destructing testing and others.

Published by John Wiley & Sons, New York City; 1074 pages; $8.50.

AMERICAN POTASH MAKES APPOINTMENT

Dr. A. J. Dirksen has been appointed Director of Sales Development for American Potash & Chemical Corporation, according to an announcement by Peter Colefax, President of the company.

Dr. Dirksen, who joined the firm in 1953, has been acting as eastern representative of the company's Sales Development Department. With his new duties, he will be responsible for planning and carrying out the corporation's sales development and market research program under the direction of Daniel S. Dinsmoor, Vice President in charge of Research and Development. Dr. Dirksen received his Ph.D. in chemistry at the University of Wisconsin.

LEEDS & NORTHRUP TO CONSTRUCT PLANT

Plans to construct the world's most modern instrument plant on a 129-acre track adjacent to North Wale, Pa., have been announced by Leeds & Northrup Company.

Estimated cost of the 250,000-square-foot building, additional equipment, utilities, landscaping, parking lot, etc., is in excess of $4 million. Present schedules call for construction to start in the early Fall, with occupancy in late 1955. Approximately 1300 of the firm's 3100 employees will be at the new location.

BALL BROTHERS TO COMPLETE MANAGEMENT MODERNIZATION

Ball Brothers Company has announced virtual completion of initial phases of its continuing program to modernize management, manufacturing and sales and the shifting of operating responsibilities from Duncan C. Menzies, Executive Vice President and General Manager, to the managers he has assembled for Ball within the last four years.

Edmund F. Ball, President of the firm, said that the company had acceded to Mr. Menzies' desire to be relieved of the duties he has been performing since 1950 as Ball's chief operating executive. He has agreed to serve as Vice Chairman of the company's Executive Committee and, as an important stockholder, will continue also to serve as a member of the Ball Board of Directors.

Mr. Menzies joined Ball Brothers in mid-1950. He had been with Johnson & Johnson and resigned a high executive position and a directorship to become associated with the firm. Before that, he was with Lamont Corliss & Company and The Hecker Products Corporation, which later became known as Best Foods, Inc. The position Mr. Menzies vacated will not be filled immediately, according to the announcement.

New Equipment and Supplies

FISHER OVEN TABLE

Fisher Scientific Company, 717 Forbes Street, Pittsburgh 19, Pa., has announced a new oven table for use in the laboratory.

The new table is bench high, 36 inches, making it possible for a heavy oven to be slid on and off without lifting. The oven can be used directly on the table when it has been rolled to the spot where it is needed. A lower shelf holds desiccators, evaporating dishes and other equipment. Shelves are 20" x 26" and can be used either as supports or trays. Adjustable corner brackets give extra security.

SURFACE AND SPOT SANDING TV TUBES

Henry G. Lange Machine Works, Inc., 166 N. May Street, Chicago 7, Illinois, has announced a new abrasive belt sander, called the Lange TV-106, for removing scratches, blemishes and defects in TV tubes and TV cabinet face plates. It can also be used for metal grinding, deburring and polishing operations.

The machine can be equipped for dry or wet sanding. It is reported that it will remove scratches in seconds that formerly required many minutes to remove. The glass surface is quickly and easily repolished after sanding with cork and felt wheels, restoring the original surface finish.

The sander comes equipped with rubber contact roller 4" wide by 5¼" diameter with serrated surface, rounded on the face for spot sanding or with a flat face for surface sanding. This affords contact between belt and glass with full vision of sanding area by operator.

DUAL-FUEL BURNER

North American Mfg. Company, 4455 East 71st Street, Cleveland 5, Ohio, has developed a Series 223 XSA dual-fuel burner for use on furnaces which either require a high degree of temperature uniformity throughout or are operated at widely differing temperatures from one day to the next.

The burner operates on gas or light oil, and in either case large amounts of excess air (up to 400%) may be put through the burner to achieve a high effective turndown, or increase temperature uniformity.

The Series 223 burner is offered in three sizes, with air capacities ranging from 3880 cfh to 9820 cfh for 16 osi air pressure at the burner. Required gas pressure at the burner is low, being 1 osi for coke oven gas, and less than that for natural gas.

MICRO-OPTICAL PYROMETER

Pyrometer Instrument Company, Inc., Bergenfield, New Jersey, has introduced a new micro-optical pyrometer designed particularly for precision temperature measurements in the laboratory yet sufficiently portable to be used for general plant applications.

The new pyrometer is a multi-purpose instrument capable of measuring targets less than .001" in diameter and, by means of supplementary lenses, can be adjusted for focal distances varying from five inches to infinity. The optical system includes a microscope type ocular providing a 20-power magnification of the object under measurement and the wide scale direct-reading meter makes it possible to reproduce temperatures with extreme accuracy.

CAM-OPERATED INDEXING UNIT

Standard Tool & Manufacturing Company, 740 Schuyler Avenue, Lyndhurst, New Jersey, has announced the development of a new cam-operated indexing unit to provide precision positioning between automatic production stations or to provide simplified means of timing production operation drives.

The automatic indexing unit can reduce machine design time by as much as 50%. Increments of either 8, 12, 16 or 20 can be obtained during a complete cycle. Accurate positioning for such operations as milling, drilling, soldering, crimping or assembly is provided at each index position. Worm and gear connections to the input shaft drive the cylindrical cam which in turn provides motion to the indexing table. All rotating shafts are mounted on tapered roller bearings to insure accuracy of all motions. Cam shaft extensions provide a means for operation of auxiliary drives or other production devices.

CATALOGS RECEIVED

Kaiser Aluminum & Chemical Sales, Inc., 1924 Broadway, Oakland 12, California, has issued a new bulletin entitled "A Report on a Better Basic Brick for the Glass Industry".

The bulletin contains a discussion of Periclase "A" Brick and Periclase "D" Brick, giving comparative thermal efficiency information on basic brick versus fireclay and discussing the effects of carry-over on physical and mineralogical characteristics. Various checker settings are illustrated and technical data including chemical analysis, physical properties and shipping information are given.

Harbison-Walker Refractories Company, Farmers Bank Building, Pittsburgh 22, Pa., has issued a revised edition of its insulating brick bulletin which includes the company's new 3000°F. insulating refractory, H-W 30. The bulletin now includes data on insulating brick in the following classes: 1600°F., 2000°F., 2600°F., 2800°F. and 3000°F.

An important feature of the bulletin is a 2-page thermal data chart giving heat losses, heat storage capacities and cold face temperatures for insulated walls built of various combinations of Harbison-Walker refractories. Data are given for hot face temperatures of 1200°F. to 3000°F. in steps of 200°F.

Walsh Refractories Corporation, 101 Ferry Street, St. Louis 7, Missouri, has published a Handbook of Fire Clay Refractories to afford helpful information as a handy reference.

The volume, 126 pages, embraces all of the company's products, in addition to providing tables, charts and other valuable data for those using, installing or specifying fire clay refractories. Chapter headings include Research and Quality Control, Fire Clay Brick, Standard and Series Shapes, High Temperature Refractory Specialties, Glass Industry Refractories, Export, Palletizing and Useful Data.

Spiral bound, the handbook is sectionalized for greater convenience and contains a section finder affording a quick and easy method of locating wanted information.

Minneapolis-Honeywell Regulator Company, Industrial Division, Wayne and Windrim Avenues, Philadelphia 44, Pa., has issued a series of catalogs.

Catalog 2320 describes all types of flow meters made by the Industrial Division. It includes indicating, recording, integrating and controlling instruments of both evenly graduated and square root types, as well as area meters and differential converters.

Bulletin 9604 describes new miniature flame rod assemblies, Photocell units, pilots and other components used in Honeywell Protectoglo combustion safeguard systems for industrial oil and gas burners. The bulletin contains specifications, dimensions, application information and price insert.

Bulletin 6430 describes the new Brown dual temperature controller, a versatile and rugged instrument which incorporates two complete systems for measuring, indicating and controlling two temperatures. The bulletin includes information on application, control forms and ranges.

Farnco Sales Company, 6213-15 Formosa Way, Pittsburgh 8, Pa., has issued a bulletin featuring its all-aluminum conveyors.

Featuring the Farnco FT-1 and FT-4, each is illustrated and discussed. Operation data is included, as well as application information.

GLASS DIVISION MEETING . . .

(*Continued from page* 253)

than those containing less magnesia.

The replica technique utilizing liquid plastics (vinylite dissolved in methyl isobutyl ketone) has shown very encouraging results in accurately revealing the corroded pattern of curved-glass contours. These replicas show promise in evaluating the durability of glass surfaces when measured by means of a photoelectric haze meter.

The next paper was from the Bureau of Standards, "Surface Tension, Density, Viscosity and Electrical Resistivity of Molten Binary Alkaline-Earth Borates", by Leo Shartsis and H. F. Shermer. The paper was presented by Mr. Shermer. The results of an investigation in the systems $CaO\text{-}B_2O_3$, $SrO\text{-}B_2O_3$, and $BaO\text{-}B_2O_3$ were reported. It was found that the area of good glasses was rather limited owing to immiscibility of the liquids at low RO concentrations.

The $BaO\text{-}B_2O_3$ presented a fairly large area of good glasses, while $SrO\text{-}B_2O_3$ glasses were quite limited. Surface tension measurements were described using a platinum ring connected to a sensitive balance. Viscosity measurements were made at elevated temperature by pulling a platinum ball through the glass by means of a balance beam connection. Barium borates showed the highest surface tension and highest densities. The strontium borates were next in line, followed by calcium borates.

The electrical resistances were determined with the aid of the platinum crucible and platinum ball. The correlation of all properties was not complete, and the paper was presented as a progress report and represented a part of a larger comprehensive study.

The last paper presented in the Glass Division was "Thermal Conductivity of Glasses", by Edwin Ruh, Harbison-Walker Refractories Company. Thermal conductivity measurements were made on three standard glasses adopted by the American Ceramic Society. The glasses were soda-lime, lead and borosilicate types. Conductivity measurements were also made on vitreous silica and a plate glass. The measurements were made on an extremely accurate apparatus developed at Rutgers University and designed originally for polycrystalline ceramic materials but proved to be well adapted for glasses.

Measurements were made using a temperature gradient technique in vacuo over the temperature range of 20° to 200°C. and were believed to have an accuracy of ± 5%. Samples about ¼ in. by 1 in. in diameter were used. The samples were first coated with a glaze in order to insure good contact with thermodes. In order to make determinations on polycrystalline material, thermodes of copper were used. The glasses investigated had a rather low conductivity; therefore, thermodes of Incanel were used. The glasses showed the following relationship: Vitreous silica the lowest conductivity, then Pyrex (7740), lead glass and plate glass. This paper offered a very encouraging method of determining accurate conductivity measurements and appeared to be applicable in the field of glass technology.

The Program Committee suggested different types of meetings, such as symposia, shorter papers and the use of papers pertaining to glass only at the Annual Fall Meeting. It was also suggested that more meetings be scheduled with other societies.

The report of the Research Committee showed that about 400 titles are now contained in the translation pool, and Corning Glass and Owens-Corning Fiberglas have been the greatest contributors.

Data are about complete on the physical properties of glass, and it is hoped to have them published in the *Bulletin* in the near future.

The Divison Secretary was authorized to send a letter to Mr. Barton, formerly of the Armstrong Cork Company, expressing symapthy on his recent illness.

The Fall Glass Meeting was announced for October 8 to 9, 1954 at Mellon Institute, Pittsburgh, Pa.

Newly elected officers for the Division were as follows: *Trustee:* O. G. Burch, Owens-Illinois Glass Company; *Chairman:* F. L. Bishop, Kimble Glass Company; *Vice-Chairman:* A. C. Siefert, Owens-Corning Fiberglas Corp.; *Secretary:* F. V. Tooley, University of Illinois. The following Program Committee was elected for the year: F. W. Mowrey, *Chairman;* John W. Michener, Owens-Corning Fiberglas Corp.; and Mr. F. R. Bacon, Owens-Illinois Glass Company.

Thirteen members of the American Ceramic Society, newly elevated to the grade of Fellow, were presented with certificates during the banquet program. The new Fellows are Van Derck Frechette, New York State College of Ceramics; Milton D. Burdick, National Bureau of Standards; Joseph A. Pask, University of California; Harley C. Lee, Basic Refractories, Inc.; William W. Kriegel, North Carolina State College; Francis W. Glaze, National Bureau of Standards; Henry N. Bauman, Jr., Carborundum Company; William W. Coffeen, Metal & Thermit Corp.; Murray R. Scott, Bausch & Lomb Optical Company; Roland B. Snow, United States Steel Company; Albert H. Couch, Libbey-Owens-Ford Glass Company; Frederick S. Thompson, Corhart Refractories Company; Milton W. Caton, Champion Spark Plug Company.

In order to be eligible for nomination to Fellowship, a member must have reached his 35th birthday, must have been a member of the Society for at least five continuous years and must have made outstanding contributions to the ceramic arts or sciences. Service to the Society is also considered in rating nominees who are otherwise qualified.

This was a very successful meeting with over 1,900 members in all divisions registered.

NATIONAL SUNGLASS WEEK

National Sunglass Week for 1954 will be the week of May 23 to 29, it has been announced by Raymond J. Walter, Secretary of the Sun Glass Institute.

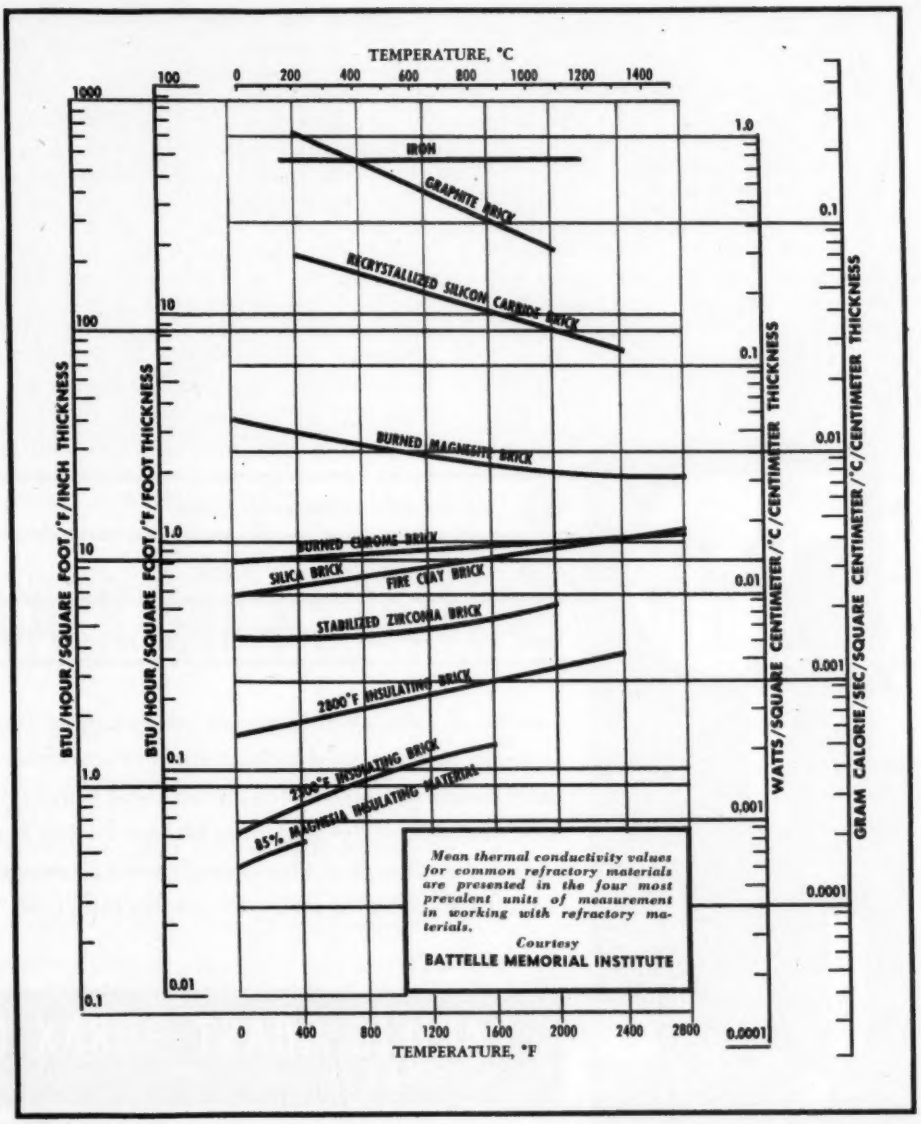
Retailers in the department store, drug and variety chain fields plan an intensified promotion of sun glasses during this week and will call attention to the importance of sun glasses as a fashion and beauty accessory and emphasize the importance of wearing sun glasses during the day in order to prevent loss of visual acuity when driving at night. Highlight of the week will be the selection of "Miss Sunglass of 1954" to signal the start of the sun glass fashion.

• John M. Barnhart has been appointed Executive Director of the Industrial Mineral Fiber Institute, Inc. Mr. Barnhart was most recently associated with Western Electric Company.

MEAN THERMAL CONDUCTIVITY CONVERSION CHART

The data available on thermal conductivity of ceramic and other materials are widely scattered and, in many cases, conflicting. In order to compare the thermal behavior of these materials on an engineering level, it is helpful to have typical values plotted in a manner that enables direct comparison of all the common units.

To give its ceramists, metallurgists, physicists and engineers a time-saving panorama of the conductivity of common materials in whatever units they might be working, Battelle Institute has developed the conversion chart below. Research scientists at Battelle use it as a desk reference piece, plotting additional data for special materials as thermal conductivity values for them become available.



RESEARCH DIGEST . . .

(*Continued from page* 273)

days before testing. A group of samples seamed on a 150-grit bonded wheel used wet were treated in the same manner as the cut group to compare both the effect of seaming and aging. The results obtained showed that the seaming and/or aging caused a general increase in the resistance of the glass to thermal shock and that the effect of aging is approximately the same in both the "as-cut" and seamed samples.

All of the samples in the previous group were seamed on a 150-grit bonded wheel, and subsequent tests were conducted to find out if the use of a coarser abrasive wheel would lower the thermal shock resistance. A 90-grit bonded wheel was used for wet-edge grinding the samples which were tested immediately after seaming. The results obtained showed that the difference in abrasive size between the 90- and 150-grit wheels had no appreciable effect on the $\Delta t \sqrt{d}$ product.

J. J. WEBBER JOINS HARBISON-WALKER

Harbison-Walker Refractories Company has announced the appointment of John J. Webber as a Sales Engineer in its Pittsburgh Technical Sales Department. He had been with Owens-Corning Fiberglas Corporation, where he served as chief furnace engineer in charge of furnace construction and refractories.

Recognized as an authority in the application of refractories to glass manufacture, Mr. Webber also did research work for Owens-Corning. Through his work, several furnace designs and a gas analyzer burner were developed, with patents assigned to Owens-Corning. He also acquired a personal patent on a timer mechanism.

Mr. Webber is a ceramic engineering graduate of the University of Illinois. He is active in the Central Ohio Section of the American Ceramic Society.

G.B.B.A. EXHIBITS GLASS FURNACE AT UNION INDUSTRIES SHOW

For the first time, the art of glass blowing was demonstrated at a Union Industries Show, according to Lee W. Minton, President of the Glass Bottle Blowers Association, AFL. Mr. Minton announced the building of the largest portable glass furnace in the world by the Union which was demonstrated at the recent Show.

Mounted on iron casters and standing a little more than six feet in height, the furnace is dwarfed by the house-sized furnaces which make bottles by the millions today in glass container plants. The portable unit holds a batch of 300 pounds and melts it down in 24 hours with a gas-flame heat of 2400 degrees. The furnace was started the day before the Show opened on March 31 and was kept at the melting heat day and night until the Show ended on April 6.

Three veteran glass blowers, who have spent about 50 years of their lives at their craft, demonstrated their art at the Show. They were Lorenzo Lober and Lewis Hund of Millville, New Jersey, and Val Hamer of Baltimore.

In addition to the exhibition of the glass furnace, the G.B.B.A. gave away a grand prize of a 15-foot Fiberglas Cabin Cruiser.

In container ware batch

B_2O_3*

ANHYDROUS BORAX
ANHYDROUS RASORITE
BORAX — BORIC ACID

Speeds melting rate

Speeds fining rate

Improves durability . . . appearance

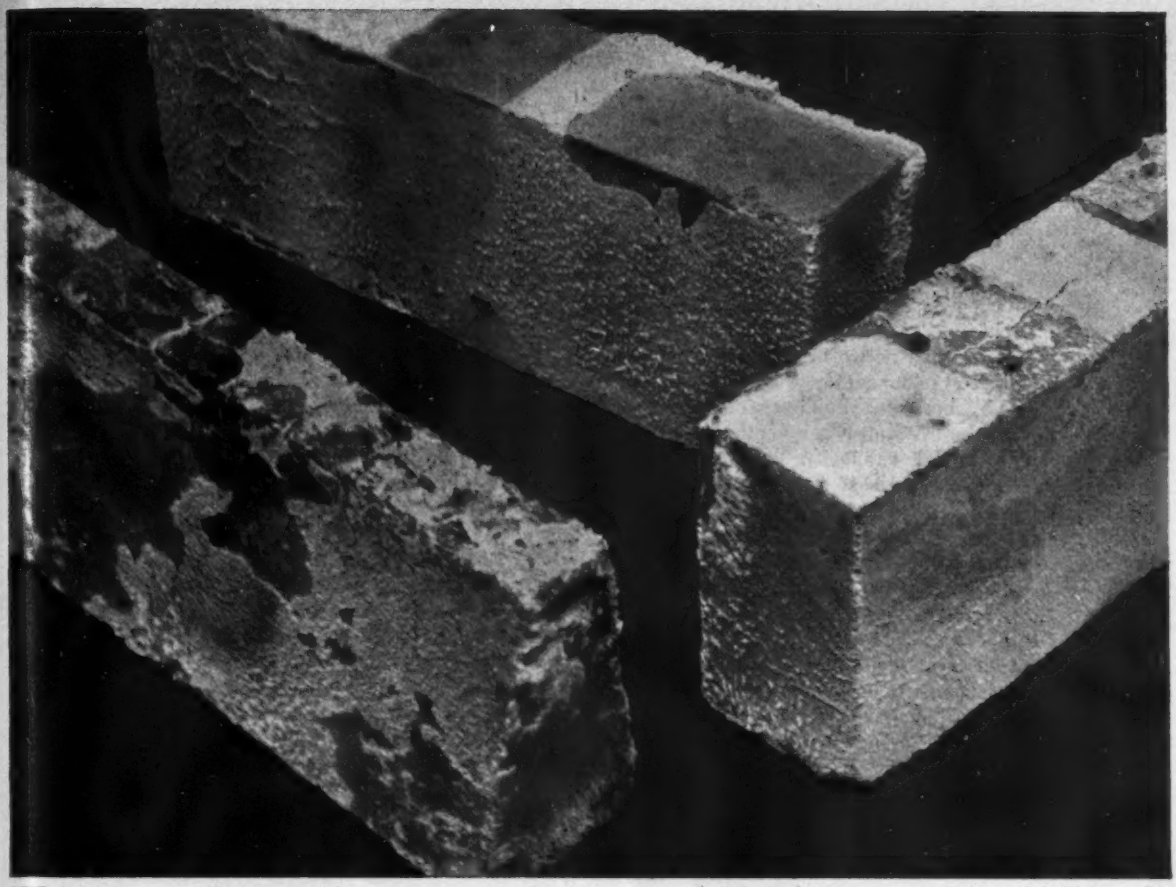
Container ware manufacturers are becoming increasingly aware of the merits of B_2O_3 as a minor constituent. A primary source of supply is the Pacific Coast Borax Co. with its continuous record of supplying highest quality boron compounds for more than fifty years. One single organization—from mine to refined product—assures top grade.

PACIFIC COAST BORAX CO.

DIVISION OF BORAX CONSOLIDATED, LIMITED

MANUFACTURERS OF FAMOUS 20 MULE TEAM PACKAGE BORAX

NEW YORK • CHICAGO • CLEVELAND • LOS ANGELES



LEFT: Arch Permanente Periclase D brick from top course under #1 port area. **CENTER:** Straight Permanente Periclase D brick from #2 course under #1 port area. **RIGHT:** Straight Permanente Periclase A brick from high course under #1 port area.

CHECKER BRICKS OUTLAST FULL CAMPAIGN!

THE Permanente Periclase checker bricks shown above were taken from a continuous bottle tank furnace after the completion of a full *three-year* campaign. Note their almost perfect condition.

During the entire campaign not one Permanente brick failed! Examinations showed the bricks would have given an additional 12 months—and possibly 18 months service—for a total of from 4 to 4½ years!

This remarkable performance is possible because Permanente Periclase bricks are *designed especially* for glass furnaces.

This means that Permanente Periclase bricks can provide *greatly extended checker life* for your regenerative continuous glass furnaces.

Call or write *Kaiser Chemicals Division,* Kaiser Aluminum & Chemical Sales, Inc. Regional Sales Offices: *Oakland* 12, California, 1924 Broadway; *Akron* 8, Ohio, First National Tower Bldg.; *Chicago,* 518 Calumet Bldg., 5231 Hohman Ave., Hammond, Ind.

Operating Data on furnace containing these Permanente Periclase Checker Bricks

Life—Operating days	1038
Pull—Total tons of glass melted	109,423
Average tons of glass per operating day	105.4
Total tons of glass per square foot of melting area during campaign	156.3
Square feet of melting area per ton per day	6.64

Kaiser Chemicals

Pioneers in Modern Basic Refractories

Basic Refractory Brick and Ramming Materials • Dolomite Alumina • Magnesia • Magnesite • Periclase

Standard and special shapes available wherever your plant is located. Supplied both burned and unburned, in the following types: Periclase A and Periclase D for checkers; Periclase D for port arches and side walls; Periclase D and Chrome-Periclase A for checker chamber crowns and walls.

Installation advice on request

COMMERCE DEPARTMENT AWARDS

Dr. Herbert Insley, retired Chief of the National Bureau of Standards' Mineral Products Division, has received the Department of Commerce Gold Medal for Exceptional Service. The award was made for "outstanding achievement in the field of petrography and microscopy, particularly as applied to glass and to hydraulic cements, and for his extremely able leadership in the ceramic profession for many years". Dr. Insley retired from the Bureau in December 1953.

Dr. Insley is internationally known for his researches in the microstructure and chemistry of mineral products. He has specialized in petrography, X-ray diffraction techniques and electron microscopy of inorganic and nonmetallic minerals, and is the author of a large number of technical papers in his field. Publication of the book, "Phase Diagram for Ceramists", co-authored by Dr. Insley and Dr. F. P. Hall, resulted in the two men being chosen as the first recipients of the Ross Coffin Purdy Award.

Dr. Donald Hubbard, National Bureau of Standards, has received the Department of Commerce Silver Medal for Meritorious Service for "very valuable contributions to the science of the structure of glass, and for meritorious authorship".

Dr. Hubbard has been a member of the staff of NBS since 1925, specializing in the study of glass and ceramics. He has contributed extensively to the technology of glass, developing a unique method, known as the interferometer procedure, for determining the chemical durability of glass and also instituted the measurement of a property of glass called hygroscopicity. This work and his research on the surface tension of glass have brought results that extend into the whole field of physical chemistry.

PROMOTIONS AT STAUFFER CHEMICAL

Milton W. Melander has been appointed Export Sales Division Manager of Stauffer Chemical Company, its subsidiaries and associated companies, it has been announced by Hans Stauffer, Executive Vice President.

Mr. Melander, who will have his headquarters in New York City, joined Stauffer in 1923, and was Pacific Coast Export Manager since 1942.

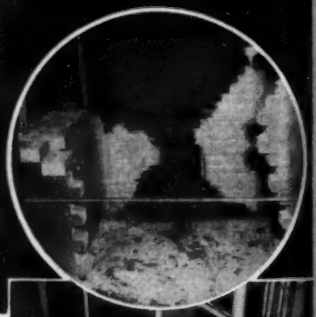
Also announced was the promotion of Kenneth H. Allen as Director of Purchases. Mr. Allen joined Stauffer in 1944 and was purchasing agent for the company's Western operation with offices in Los Angeles. Mr. Allen will also headquarter in New York City.

L-O-F ISSUES MANUAL ON PANORAMIC WINDSHIELDS

A new manual explaining the removal and installation of the new Panoramic windshields and Tuf-flex backlights in 1954 Buicks, Cadillacs and Oldsmobiles is being offered to safety glass replacement shops by Libbey-Owens-Gord Glass Company.

Harold J. Yerger, Manager of distributor safety glass sales for the company, said the new 20-page manual contains step-by-step instructions and is widely illustrated with explanatory photographs and drawings.

Why Not MODERNIZE when you next shut down for REPAIRS ?



TECO

EXPERIENCE and COUNSEL will assure Top Results!

Periodic shutdown for repairs are inevitable. But manufacturers can anticipate them—contact TECO engineers and exchange views as to objectives and possibilities for modernization and basic improvements.

Then, drawing upon their vast and diversified experience, TECO engineers can develop the plans and make provisions to "move in" at the right time.

Thus, changes can be made with minimum delay and expense; and the end result will be a strictly modern plant that will run more smoothly, reduce costs and put the owners in a more favorable position to meet competition.

A consultation as to possibilities will entail no obligation.

Photos showing repair and modernization operations on a port and uptake while a temperature of 2500 degrees was maintained in the adjacent port.

TOLEDO ENGINEERING Company

GLASS MELTING and MANUFACTURING EQUIPMENT

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Constant control of quality

Quality control is a continuous job. It is carried out with modern equipment and painstaking attention to detail in every phase of the production of Nialk chemicals.

for example...

NIALK CARBONATE OF POTASH: The controlled quality and uniformity of NIALK Carbonate of Potash contribute importantly to the production of flawless glass, suited to such specialized applications as television picture tubes.

Every step in the production of this and all NIALK products is rigidly controlled to give absolute satisfaction in many types of applications.

NIAGARA ALKALI COMPANY

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Nialk®

LIQUID CHLORINE
CAUSTIC POTASH
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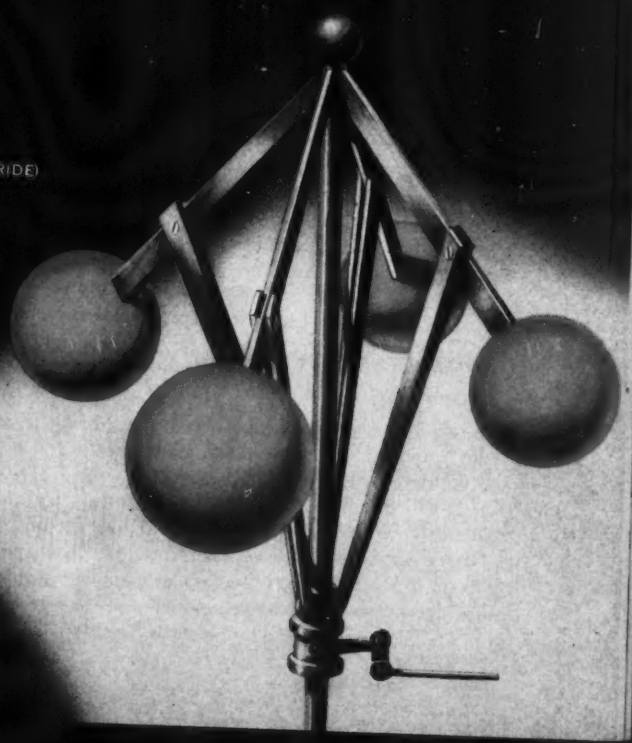
CAUSTIC SODA
TRICHLORethylene

NIAGATHAL® (TETRACHLORO PHTHALIC ANHYDRIDE)



LIFE BEGINS AT 52 . . .

(*Continued from page* 259)

tones and shades include Kelly green, burnt orange, Caribbean blue, rose and amethyst.

The major interest of the buyers, however, centered around the neutral color which is known as "Twilight" and can be blended with almost any variety of color combinations. There are abstract and delicate ceramic renditions in glazed effects. All of the designs are fired permanently into the glass. Houze decided to enter the tableware field to bring into the home the striking and rare glass colors which the company has developed over many years for use in sun glass lenses and other technical products. The gift line will be available in gift shops and department stores throughout the country.

The table accessory line is but the forerunner of a complete formal dinnerware set in colored glass which will be introduced this summer. Designed by Tommi Parzinger, well-known for his creations in wrought iron and brass accessories, the Houze Tableware line is said to be a new concept in dining room living. According to Mr. Parzinger, the rare combination of colored glass and ceramic design makes the glassware unlike anything on the market today. The complete service will include everything from a basic starter set (cups, saucers and plates) to butter dishes, wine glasses, candle stick holders and even ash trays.

To keep pace with this new production tempo, Houze has expanded its personnel and created several new executive posts including a Director of Sales, Director of Industrial Relations and Comptroller. It has broadened its advertising and public relations program which is being handled by Tyndall Associates, Inc., public relations counsel, New York. Different trademarks for each of its new lines are being set up and for the first time the company is promoting itself directly to the retail trade.

In addition to its principal sales offices in New York and Chicago, the company recently opened a sales office in Washington, D. C. This step is in line with the company's new policy to expand sales representation nationally in order to improve coverage for present as well as anticipated and diversified demand for technical and consumer glass products.

The diversification program will not mean there will be any let up in supplying the sun glass industry with lenses or in producing private mold work for such old and distinguished customers as Eversharp, Eastman Kodak, Bendix Aviation and others. This service is continuing uninterrupted. In fact, with recent discoveries in new colors and decorating techniques, Houze visualizes an increased demand for work in the plant's private mold shop.

GLASS TANK FURNACES . . .

(*Continued from page* 257)

the soda content of the container glass being lower than the standard soda-lime-silica glass, making the glass a little less corrosive.

It will be noted that some of the factors by which the quantity "a" is adjusted are multiplying factors whereas others are to be added. Therefore, the order in which the various adjustment factors are applied would make a difference in the final value obtained. The order shown in the foregoing follows Gould's example, and should be adhered to unless or until further developments indicate the wisdom of changing. The differences obtained by making the adjustment in a different order than that used by Gould are minor in magnitude.

TABLE 4

Glass Depth (ft.)	m	n
2.5	1.032	0.000022
3.0	1.056	.000037
3.5	1.076	.000051
4.0	1.092	.000064
4.5	1.105	.000076
5.0	1.115	.000087

Example:

Data available

Area of tank	238 sq. ft.
Mean temp.	2543°F
Q_o	4.48
Depth	3 ft.
Fe_2O_3 in glass	0.06%
Flux line blocks	sillimanite

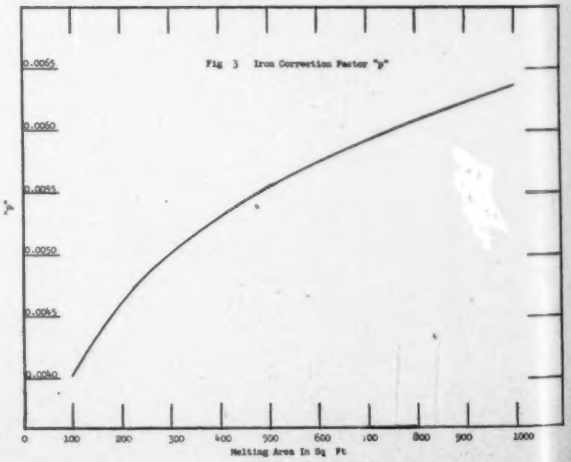
General Utility of Performance Quotient

The work of Gould on the aging factor is an illustration of the type of research that can be carried out on furnaces by application of the performance formula. Differences in performance due to type of glass, selection of refractories, changes in physical dimensions and methods of operation can be reduced to a common denominator so that the effect of each element can be isolated. Furnaces of different sizes and with different outputs can be compared regardless of their age.

Obviously, the performance formula does not take the place of judgment, but if intelligently used, it can provide the combustion engineers with a great deal of factual information.

REFERENCES

1. *Hampton, W. M.* "A Proposed Method for Calculating the Performance of Glass Tank Furnaces," J. Soc. Glass Tech. 25, P. 249-269 (1941).
2. *Moorshead, W. A.* "Principles Underlying the Calculation of Furnace Performance," J. Soc. Glass Tech., 25, P. 270-288, (1941).
3. *Gould, C. E.,* "The Use of the Furnace Performance Formula for Estimating the Coal Consumption of Glass Melting Tanks," J. Soc. Glass Tech., 36, P. 330-345, (1952).



CURRENT STATISTICS . . .

(*Continued from page* 275)

facturers have shipped a total of 29,554,195 gross. This is .8 per cent below the 29,800,204 gross shipped during the corresponding period in 1953.

Stocks on hand at the end of March 1954 were 11,991,000 gross, which is 4.5 per cent less than the 12,563,067 gross on hand at the end of February and 32.4 per cent higher than the 9,055,924 gross on hand at the end of March 1953.

Automatic tumbler production during February 1954 was 5,354,616 dozens. This is a rise of 3.3 per cent from the 5,180,462 dozens produced during January. During February 1953, production was 6,387,101 dozens. Shipments also rose during February and were reported to be 5,063,867 dozens. This is a jump of 15.1 per cent from the previous month's 4,399,343 dozens. During February 1953, shipments were 5,540,919 dozens. Stocks on hand at the end of February 1954 were 9,980,328 dozens. Compared with the previous month's stocks of 10,356,210 dozens, stocks have depleted 3.6 per cent. Stocks at the end of February 1953 were 9,565,984 dozens.

Production of automatic tumblers during March 1954 was 6,067,264 dozens. This is an increase of 13.3 per cent over February production. During March 1953, production was 6,777,783 dozens. Shipments also continued on the upswing and were reported to be 5,654,414 dozens, or 11.6 per cent above February. Shipments during March 1953 were 5,907,810 dozens. Stocks on hand at the end of March 1954 were 10,272,027 dozens, or 2.9 per cent higher than February stocks. Stocks on hand at the end of March 1953 were 10,230,080 dozens.

Table, kitchen and household glassware: Manufacturers' sales of machine-made table, kitchen and household glassware during February 1954 were 3,121,535 dozens. This is 13.5 per cent higher than the 2,750,140 dozens sold during January 1954. Sales during February 1953 were 3,655,728 dozens. At the end of the 12-month period ending February 1954, manufacturers' sales had reached a total of 38,329,669 dozens, which is 7.8 per cent less than the 41,582,550 dozens sold during the corresponding period in 1953.

Manufacturers' sales during March 1954 jumped 21.7 per cent over February sales and were reported to be 3,801,773. Sales during March 1953 were 3,667,047 dozens. At the end of the 12-month period ending March 1954, sales had reached a total of 38,464,395 dozens. This is 7.9 per cent under the 41,800,897 dozens sold during the corresponding period in 1953.

ACHESON COLLOIDS APPOINTS SERVICE ENGINEER

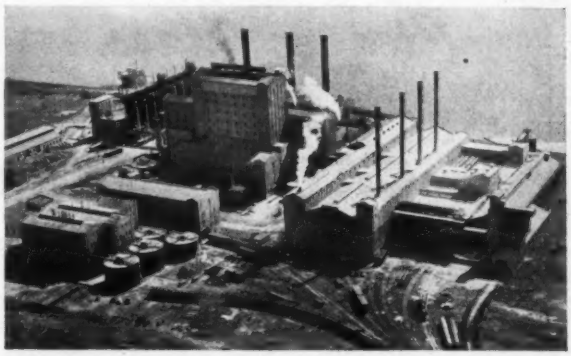
Acheson Colloids Company has announced the appointment of Clifford T. Olsen as Service Engineer.

Following a tour of duty with the U.S. Navy in the European and Pacific theaters, Mr. Olsen was graduated from Lafayette College in 1950 with a Bachelor of Science degree in Metallurgical Engineering. Prior to his association with Acheson, Mr. Olsen was employed by Hanson-Van Winkle-Munning Company and Automotive Rubber Company as electro-chemist and sales engineer, respectively.

Milestones in Glass Progress

PHOTO COURTESY CORNING MUSEUM OF GLASS

1500 B.C. Before the discovery of the blowpipe, ancient Egyptian glassmakers crafted their wares by winding rods of hot, softened glass around a core of sand. This exquisite, 4½-inch vase is an example of their painstaking workmanship. It dates back 3500 years, and probably was an oil or cosmetic container.



1890 Michigan Alkali Company, now a division of Wyandotte Chemicals Corporation (North Plant, above), was founded by Captain J. B. Ford to supply Soda Ash to the glass industry. Wyandotte has grown up with glass. Today, as in the past, it is a working partner, supplying technical assistance and raw-material chemicals to those great companies marking milestones in glass progress.

Wyandotte
CHEMICALS

Wyandotte Chemicals Corporation, Wyandotte, Michigan
Offices in Principal Cities

Founded by a Glassmaker to Serve the Glass Industry

WESTVACO APPOINTMENTS

Dr. William L. Davidson has been appointed Research Director and William B. Rose has been named Manager of the Development Department of the Westvaco Chlor-Alkali Division of Food Machinery and Chemical Corporation, it has been announced by Franklin Farley, Division President.

Prior to joining the firm in January 1954, Dr. Davidson was for three years Director of the Office of Industrial Development of the Atomic Energy Commission in Washington. He was previously associated with the B. F. Goodrich Company and the Monsanto Chemical Company.

Mr. Rose joined Westvaco following graduation from the University of North Carolina in 1935. Prior to his new assignment, he had been Assistant Technical Director of the Westvaco Chemical Division.

L-O-F ANNOUNCES NEW TUF-FLEX THICKNESS

An impetus to store modernization is forecast in the announcement of a new ½-inch Tuf-flex heat tempered polished plate glass door by Libbey-Owens-Ford Glass Company.

E. M. Everhard, Vice President in charge of Sales, in announcing the new door, said it would be about a third lighter than the former standard Tuf-flex door which was ¾-inch thick, making it easier to handle, install and operate. New fittings have been designed with a modern and clean-lined appearance. The present locks, bolts, floor checks, door holders and other accessory equipment used on ¾-inch doors will be used in the new doors.

CORNING ELECTS NEW OFFICERS

The election of four new officers of Corning Glass Works has been announced by Amory Houghton, Board Chairman. Named Vice Presidents are Russell Brittingham, General Manager of the company's Technical Products Division; John Carter, General Manager of the Consumer Products Division; and Thomas Waaland, Director of Industrial Relations. Robert W. Foster was elected Assistant Treasurer.

At the same time, four former Vice Presidents were elected Honorary Vice Presidents. They are William H. Curtiss, Harry M. Hosier, Jesse T. Littleton and William C. Taylor.

All Board members were re-elected as were officers of the company other than those newly-elected.

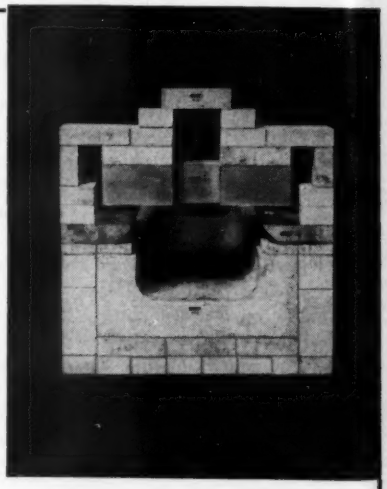
HARBISON-WALKER ADDS TO RESEARCH STAFF

Edwin Ruh, formerly a research assistant in the School of Ceramics at Rutgers University, has accepted a position with Harbison-Walker Refractories Company as a research engineer at the company's Hays Laboratory in Pittsburgh.

His doctoral thesis just completed was concerned with thermal conductivity measurements of single crystals, polycrystalline bodies and glasses. This work was sponsored jointly by the U. S. Signal Corps and the U. S. Air Force. In addition to the Ph.D. degree to be received in June, Mr. Ruh received his Bachelor's and Master's degrees at Rutgers in 1949 and 1953, respectively.

Cleaner Glass, Low Maintenance

with **CRYSTALITE Forehearths**



REMMEY CRYSTALITE (mullite-bonded mullite) is produced in all shapes necessary to make up the forehearth assembly. Burner blocks, cover blocks, channels, spouts, tubes, plungers and orifice rings are built to meet specified requirements. These CRYSTALITE parts mean better, more efficient production by offering:

- ★ Accuracy in formation to eliminate time-wasting adjustments.
- ★ High refractoriness and erosion resistance for longer life, fewer replacement shutdowns and cleaner glass.
- ★ Rigid control through each production phase for uniform quality and dimension accuracy.

Get Premium Performance Without Premium Price . . . by using REMMEY CRYSTALITE parts for your forehearth.

Dependable Refractories

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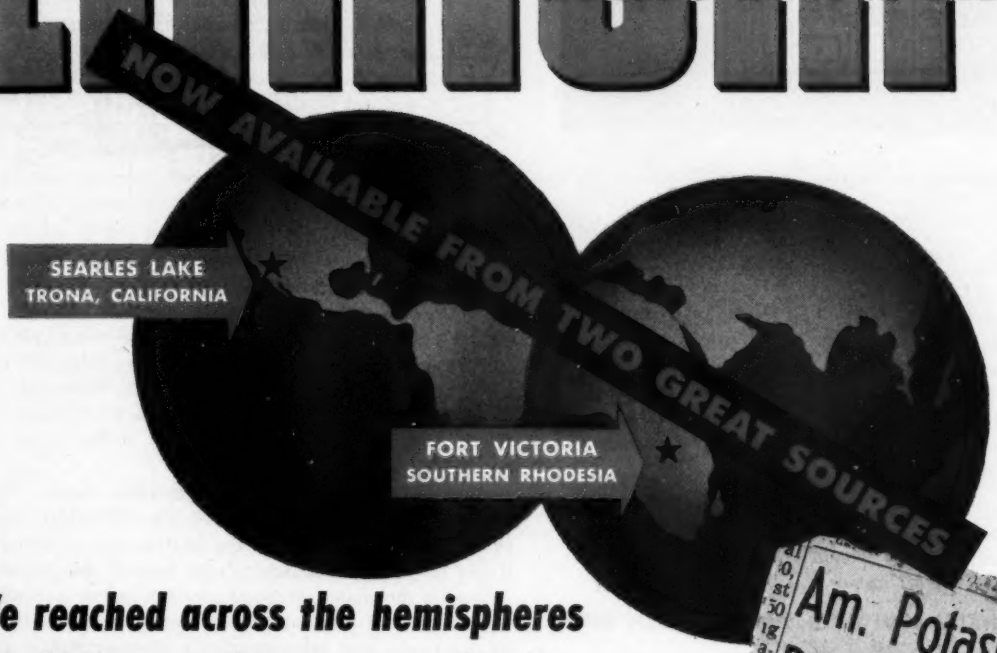
Lithium

WORLD'S WONDER CHEMICAL



We reached across the hemispheres to bring you this new supply of high-grade Bikita Lithium Ores...

LEPIDOLITE (3.5% minimum Li_2O) and PETALITE

To meet the growing demands of Industry for Lithium products we offer the addition of high-grade Lithium ores — Lepidolite (3.5% minimum Li_2O) and Petalite—from large deposits in Southern Rhodesia to the Lithium Carbonate already available from the brine deposits of Searles Lake in California. Used in its various forms in high quality glass, porcelain enamel glazes, lubricating grease, storage batteries, heat treating operations and humidity control, Lithium, the wonder chemical, will work wonders for you. Let Trona research, together with Trona's growing supply of this critical raw material, help you with your production problems. Write today for technical data.

Am. Potash Broadens Field

American Potash & Chemical Corp., long a leading producer of lithium products, has broadened its activities in this field with the offering of lithium ores from a new source in Africa, President Peter Colefax announced yesterday.

The company has completed arrangements to handle lepidolite and petalite ores mined from a large deposit of high-grade lithium-bearing minerals located near Ft. Victoria, Southern Rhodesia. The property is owned and will be operated by Bikita Minerals, (Private) Ltd., under the management of Selection Trust, Ltd., a London mining concern with world-wide interests. American Potash & Chemical and the American Metal, Ltd., were associated with Selection Trust, Ltd., in financing and developing the project.

Primary Uses

Excerpt from Los Angeles TIMES, November 19, 1953

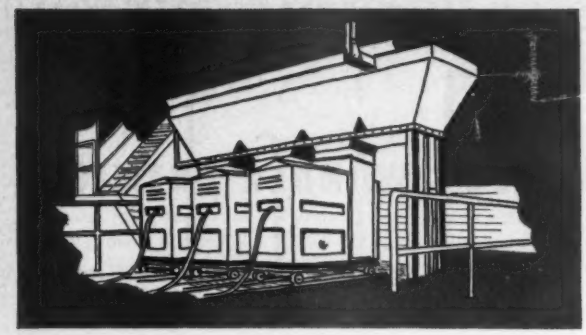
TRONA
INDUSTRIAL AND AGRICULTURAL CHEMICALS

American Potash & Chemical Corporation

Offices • 3030 West Sixth Street, Los Angeles 54, California
122 East 42nd Street, New York 17, New York

Plants • Trona and Los Angeles, California

BORAX • POTASH • SODA ASH • SALT CAKE
LITHIUM CHEMICALS • BROMINE CHEMICALS
and a diversified line of specialized Agricultural, Refrigerant and Industrial Chemicals



Uniform Chemical Ingredients
For Uniform High Quality Glass
...GOLD BOND GLASSHOUSE LIME

Every step in the processing of Gold Bond Glasshouse Lime is rigidly controlled from mine to end product to assure you of consistent high quality in every shipment. Lime variables are eliminated...a vital factor in the production of *good* glass. And National Gypsum Company *alone* offers the glass industry a complete line of *tested* lime products.

High Calcium Limestone
Dolomitic Limestone
Dolomitic Quicklime
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SEALING GLASS or SEALING GLASS-TO-METAL?

Then KAHLE Machinery Is Best For You ... largest manufacturer of sealing machines for the electronics and allied industries.

Experience with the widest range of products to be sealed—whether all glass seals or glass-to-metal seals—makes Kahle your logical source for sealing machines—stationary, automatic or combination Kahle automatic combination machines seal and exhaust in one operation—produce up to 2000 units each hour! Regardless of your product or production requirement, write KAHLE.

Special experimental and research services offered by Kahle include:

- Special glass parts and accessories
- Special tools for research
- Special models
- Small-lot manufacture of special items for research or development
- Regular industrial engineering at regular fee or contract rates
- Special tubes, lamps, etc. for research purposes including elements and parts
- Any special equipment for manufacture or research for tubes or lamps

Kahle ENGINEERING COMPANY
1314 Seventh Street • North Bergen, New Jersey

INVENTIONS AND INVENTORS . . .
(*Continued from page 271*)

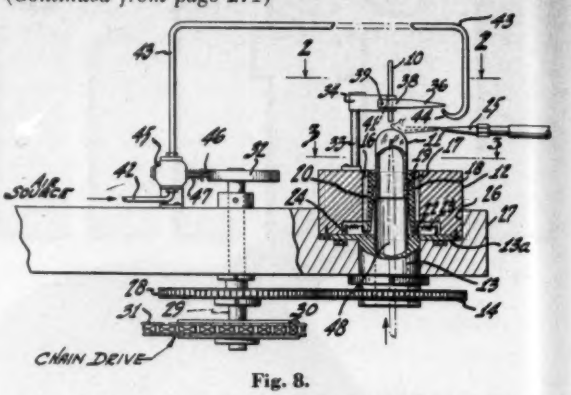

Fig. 8.

to the glass surface it is to engage. A spring-loaded link 40, between the bracket 36 and support 33, resiliently holds the bracket against stop 37.

The patent contains 3 claims and the references cited were as follows: 117,208, Richardson, July 18, 1871; 278,845, Atwater, June 5, 1883; 537,125, Rovensky, Apr. 8, 1895; 2,169,455, Wagner, Aug. 15, 1939; 2,527,791, Brink, Oct. 31, 1950; and 2,528,206, Giffen et al., Feb. 24, 1953.

Apparatus for Joining Glass Tubes and Bulbs. Fig. 8. Patent No. 2,662,345. Filed February 23, 1951. Issued December 15, 1953. One sheet of drawings. Assigned to Radio Corporation of America by John V. Ruggiero.

During the manufacture of electron tubes, it is advantageous to first form sub-assemblies of the parts making up the tubes, and subsequently to appropriately arrange and fix the sub-assemblies to form completed tubes. As shown in Fig. 8, the dome of the bulb 11 is rendered sufficiently plastic for sealing to the lower end of the tubulation 10. To accomplish the seal, it is necessary that the tubulation be urged downwardly.

Rotation of the bulb by the sleeves 12, 13, spur gears 14, 28 and chain 31 for uniform application of the flame to the dome of the bulb and results in rotation of cam 32. Such rotation of cam 32 causes the valve stem 46 to be successively moved in and out resulting in successively opening and closing the valve 45. The opening and closing of valve 45 causes an air jet to be intermittently directed by nozzle 45 to the underside of vane-like arm 36. The force of the air jet causes the arm 36 to rotate counterclockwise to a sufficient degree to intermittently release the tubulation 10. The intermittent release of the tubulation 10 causes it to abut against the softened dome of the bulb 11.

The patent contains 11 claims and the following references were cited: 1,626,683, Madden, May 3, 1927; 1,628,410, Koning, May 10, 1927; 1,789,011, Mailey et al., Jan. 13, 1931; 1,793,320, Horn, Feb. 17, 1931; 2,272,927, Stager, Feb. 10, 1942; and 2,553,135, Eisler, May 15, 1951.

Miscellaneous Processes

Quartz-To-Metal Seal. Fig. 9. Patent No. 2,664,180. Filed May 1, 1948. Issued December 29, 1953. One sheet of drawings. Assigned to General Electric Company by Leo R. Peters.

This invention relates to quartz-to-metal seals for electric devices, such as electric discharge lamps. In making

the seal, the cups 7 and 8 are positioned on the rod 2 and against the disc 4 brazed to the rod as shown in Fig. 9. The portions of the rod 2 extending outward from the cups 7 and 8 are then wrapped with molybdenum foil 3. This assembly is then inserted into two quartz tubes 21 and 22 which extend beyond the ends of the rod and each of which has a flare 23 and 24 at one end. One of the flares, which may be flare 23, has a ring 25 of quartz fused to its face which bears against the other flare 24 to space the flares 23 and 24 apart and acts as a baffle to slow the escape of gas from the chamber formed by the two tubes 21 and 22.

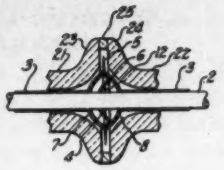

Fig. 9.

With the tubes in this position inactive gas, such as nitrogen, at slight pressure is forced into the chamber through the ends of both tubes 21 and 22 and escapes through the space between the ring 25 and the opposite flare 24 carrying with it the air present in the tubes. The ring 25 is then fused to the other flare 24 to splice the tubes, care being taken to avoid fusing the quartz to sealing edge 5 of the disc 4.

The patent contains 4 claims and 10 references were cited.

METRO GLASS TO ERECT PLANT IN ILLINOIS

Ground was broken and construction started in mid-March on the 34-acre site at Dolton, Illinois, for the Chicagoland plant of Metro Glass Company, Inc.

The new plant, which is scheduled to begin operations early in 1955, initially will employ several hundred persons, according to the announcement by President E. M. Terner.

General construction work of the new plant is being done by Oscar Bohlin and Sons, Shokie, Illinois.

L-O-F ELECTS SECRETARY

Ross S. Carey, who joined Libbey-Owens-Ford Glass Company as a member of the legal department in 1948, was elected Secretary to succeed Herbert H. Baker, retired, at the recent organization meeting of the company's Board of Directors.

Mr. Carey will continue as Assistant General Counsel. The fourth secretary of the company since it was incorporated in 1916, he has served for three years as Assistant Secretary. He is a graduate of Allegheny College and took his law degree from the University of Pennsylvania.

THATCHER NAMES EXECUTIVE VICE PRESIDENT

The Thatcher Glass Manufacturing Company, Inc. has announced the election of William J. Green to the post of Executive Vice President. Mr. Green was formerly President of Stone and Company, which is now a wholly-owned subsidiary of Thatcher.

A native of Muncie, Indiana, Mr. Green was at one time associated with Ball Brothers, Inc. The Executive Vice Presidency has been open since January 1 when Franklin B. Pollock, President, was named Chairman of the Board, and Executive Vice President F. K. Rodewald assumed the presidency.

EXACT WEIGHT Scales

for accurate color control

EXACT WEIGHT Scales speed production two ways. Short lever fall and the action of an adjustable damping device bring scale indicator to rest quickly. Fractional-ounce visible indication makes possible an accurate reading at a glance. These important features trim seconds off each weighing operation. Note how the end-tower design permits a free flow of work over the scale, with clear visibility of the indicator. Model 910, shown, is ideal for color control in glass, and for other operations calling for speed and accuracy in weighments up to 25 pounds. Also available in 50-pound capacity. Send coupon for details.

Sales and Service from Coast to Coast

Exact Weight Scales

Better quality control

Better cost control

THE EXACT WEIGHT SCALE COMPANY

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2920 Bloor St. W., Toronto 18, Canada

Send complete information on Model 910.

Name .....

Address .....

City..... Zone.... State.....

KARL TURK FELLOWSHIP ESTABLISHED AT HARVARD

A new fellowship established to provide broad training in business administration for potential leaders of the ceramics industry has been announced by the Harvard Business School.

The Karl Turk Fellowship, established in the name of Pemco Corporation's Chairman of the Board, has been established by the Pemco Foundation of Baltimore, Maryland, in an effort to attract qualified men into the ceramic field and to broaden the education of those who have had the technical training. The Fellowship is an outright scholarship in the amount of $2,500 for each of the two years of study leading to the degree of Master in Business Administration at the School.

THATCHER EXECUTIVE DIES

William H. Mandeville, Vice President, Director and Chairman of the Executive Committee of Thatcher Glass Manufacturing Company, died suddenly at Palm Springs, California.

A Director of Thatcher since 1936, Mr. Mandeville was made Vice President in 1940. On the death of his father, he replaced him on the Executive Committee in 1943 and a year later was named Chairman of the Executive Committee.

At the time of his death, Mr. Mandeville was in California with Thatcher President F. K. Rodewald to attend a Glass Container Manufacturers Institute conference and to inspect a new Thatcher plant under construction at Saugus, California.

A. P. GREEN SUBSIDIARY ACQUIRES THERMO FIRE BRICK

The A. P. Green Fire Brick Company of Texas, a subsidiary of the A. P. Green Fire Brick Company, has acquired the Thermo Fire Brick Company, Sulphur Springs, Texas, according to an announcement by William S. Lowe, President of the parent company.

The Thermo Fire Brick Company, established in Texas for more than 30 years, manufactures a complete line of fireclay refractories, specializing in high duty and intermediate duty firebrick, in dry press, stiff mud and wood mold processes. Howard Hicks, President of the Thermo company since its inception, will continue with A. P. Green of Texas.

LACLEDE-CHRISTY APPOINTMENT

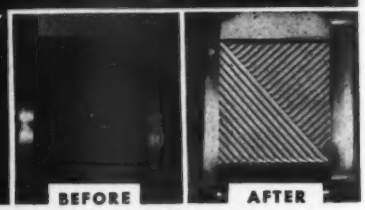
Laclede-Christy Company has announced the appointment of Roy C. Andrews as Assistant to Russell C. Stone, Director of Industrial Relations and Personnel.

Mr. Andrews was formerly Assistant Personnel Director at Rice Stix, Inc., and is a veteran of World War II and Korea.

A.C.S. SECTION MEETING

The March meeting of the Northern Ohio Section of the American Ceramic Society featured a plant tour of the Pitney Glass Works, General Electric Company, where glass envelopes for light bulbs and vacuum tubes are produced at the rate of hundreds per minute. A social hour followed.

Hydro-Finish leaves glass molds READY for USE!



Actual untouched photos of mold before and after cleaning with Hydro-Finish

Complicated molds are easily cleaned and left *ready for use* with Pangborn Hydro-Finish! Hand cleaning and polishing is virtually eliminated! And you save additional time and labor because a Hydro-Finish machine, operated by one man, removes discoloration and scale in *minutes* instead of hours!

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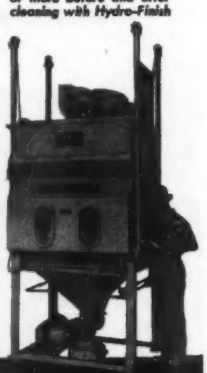

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• Glass is used in more motels than any other type of drinking cup, according to a recent survey made by *American Motel Magazine*. The sums of 261 replies to the question, "What kind of drinking cups do you have in your bathrooms?", are as follows: Glass, 75%; Paper, 20%; Plastic, 5%.

• Corning Glass Works has been advised that its match book was selected as the best issued during 1953 in the industrial services category on the vote of a panel of 16 outstanding advertising and marketing leaders. The judges chose the winner on the basis of its simplicity and strength in the use of name identification.

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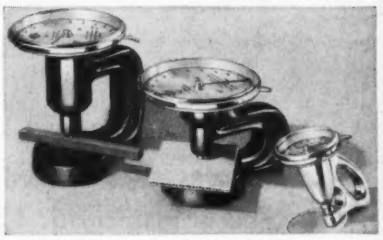

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